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A THIRD LOOK AT MINNESOTA'S TIMBER

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FOREWORD

The Third Survey of Minnesota's timber resources, discussed in this report, was made between 1959 and 1963. It fulfills Federal responsibilities outlined by the McSweeney-McNary Forest Research Act of May 22, 1928, which directs the U.S. Department of Agriculture to periodically examine and evaluate the forest resources of the Nation.

The Lake States (now North Central) Forest Experiment Station designed the procedures to produce results that would be additive to those of the other Lake States and of the Nation. An advisory committee of private and public forestry leaders helped the Station define objectives and coordinate cooperative efforts.

Forest area, volume, growth, and desirable cut statistics in this report are presented as of 1962. Timber cut, forest products output, and other forest industry statistics are for 1960. Additional statistics have been published in county and district reports by the Office of Iron Range Resources and Rehabilitation and in Research Notes by the Lake States Station.

Without the cooperation of many other groups, we could never have achieved the unusual depth that was accomplished in the Third Survey. Individuals and organizations that provided major cooperation with the Forest Service are Leonard Rowson and Alexander Vasilevsky, Office of Iron Range Resources and Rehabilitation; Clarence Buckman, Minnesota Department of Conservation; Clarence T. Eggen, Bureau of Indian Affairs; John Hubbard and Arthur Ennis, Minnesota and Ontario Paper Company; and Ernest George, Kimberly-Clark of Minnesota, Inc. Other individuals within the Forest Service who deserve special mention are Virgil Findell, Eastern Region, and Arthur Horn and Clarence Chase, North Central Forest Experiment Station. Mr. Chase directed the entire project.

Stone, Robert N.

1966. A third look at Minnesota's timber. North Central Forest Exp. Sta., St. Paul, Minn. 64 pp., illus. (U.S. Forest Serv. Resource Bul. NC-1)

This report presents timber resource statistics for 1962 and compares them with those for 1953 and 1936. It contains 17 line illustrations and 50 tables that deal with forest area, number of trees, timber volume and growth, desirable cut, timber product output, and timber cut statistics. It also includes a 30-year projection of timber growth and cut. The comparisons show that timber volume has increased 37 percent since 1953, as Minnesota's second-growth forests approach maturity. Aspen dominates the resource in nearly all aspects. Though the acreage of commercial forest land is slightly less than before, a growing surplus of pulpwood-size timber suggests that the existing stands can support a larger cut than was advocated in 1953.

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A THIRD LOOK AT MINNESOTA'S TIMBER

by

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Published by

NORTH CENTRAL FOREST EXPERIMENT STATION[2]

D. B. King, Director

FOREST SERVICE — U. S. DEPARTMENT OF AGRICULTURE

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TREND HIGHLIGHTS

Recently, Minnesota's timber volume has expanded considerably. Between 1936 and 1953 it increased only 10 million cords. Since 1953 another 34 million cords have been added, including increases of 28 percent for softwoods (reversing a downward trend) and 41 percent for hardwoods.

Timber quality trends, however, reflect smaller trees than before. Compared with 1953, the State has 13 percent more hardwoods and 2 percent more softwoods under 11 inches d.b.h. This has lowered the average saw log quality. In 1953 about 33 percent of the hardwood sawtimber volume was in No. 1 and No. 2 grade logs; by 1962 the figure was only 22 percent.

Forest land has diminished about 3 percent since 1936, but present farmland retirements and reforestation activities may reverse this trend. Public agencies still control about 56 percent of the commercial forest land — the same as was noted in 1953 and more than any other State east of the Rocky Mountains. Minnesota also has more county-owned commercial forest land than any other State and is second only to Michigan in State Forest acreage. Compared with the other Lake States, relatively little of Minnesota's forest land is owned by industry.

Tree planting has increased sharply. More trees — principally red pine — were planted from 1955 through 1964 than in all former years combined. More than half of the 3.6 million acres that were nonstocked in 1953 have been restocked either by natural regeneration or by reforestation. Growing stock volume is up, too, from 5.0 cords per acre in 1953 to 7.3 cords at present. Also, sawtimber and poletimber acreages have increased substantially.

These statistics lead to the conclusion that the annual desirable cut is on the increase. In fact, the calculated desirable cut of total growing stock has doubled to 4 million cords since 1936. The hardwood sawtimber desirable cut has doubled, also, but that of softwood sawtimber has increased only 5 percent.

The harvest has not kept pace. Timber cut has declined from 1.9 million cords in 1953 to 1.6 million cords in 1960 (evenly divided between hardwoods and softwoods). Yet the total cut in 1960 exceeded that of 1936 by 14 percent, and that of aspen nearly doubled. The pulpwood portion of the total cut increased from 27 to 60 percent since 1936, while the fuelwood portion dropped from one-third to just one-eighth of the product volume.

The details of these trends are discussed in the sections that follow. Statistics are presented in tables 1 through 50 in the Appendix.

	1936 Survey	1953 Survey	1962 Survey
Forest type areas:		*Million Acres*	
Pine	1.6	1.3	1.3
Spruce-fir	1.1	1.2	1.2
Conifer swamp	2.5	2.0	2.4
Upland hardwood	1.9	2.0	2.1
Lowland hardwood	.6	1.1	2.0
Aspen-grass-brush	10.4	9.7	8.1
Nonproductive and other[1]	1.5	2.0	2.0
Total	19.6	19.3	19.1
Stand-size area:		*Thousand Acres*	
Sawtimber stands:			
Softwood types	644	548	631
Hardwood types	876	1,469	1,756
Poletimber stands:			
Softwood types	2,077	1,855	2,434
Hardwood types	2,340	3,426	6,086
Total	5,937	7,298	10.907
Sapling and seedling stands:			
Medium- and well-stocked	4,106	4,646	3,383
Poorly stocked	4,289	1,671	911
Total	8,395	6,317	4,294
Nonstocked forest land:			
Upland	1,887	1,748	450
Swamp	1,881	2,735	1,410
Total	3,768	4,483	1,861
Timber volume:		*Billion board feet*	
Total sawtimber	11.3	12.5	15.5
Softwood	6.3	5.0	6.6
Hardwood	5.0	7.5	9.0
		Billion cubic feet	
Total growing stock	6.4	7.2	9.8
Softwood	3.0	2.8	3.6
Aspen	1.5	1.8	3.0
Other hardwood	1.9	2.6	3.2
		Million cubic feet	
Timber cut-desirable cut:[2]			
All softwood:			
Annual cut	60	78	63
Annual desirable cut	49	96	116
All hardwood:			
Annual cut	50	76	63
Annual desirable cut	108	151	203

[1] *In 1936 and 1953, this includes approximately 0.4 million acres reserved from timber production, some of which is productive timberland.*

[2] *This and other Forest Survey terms are defined in the Appendix.*

RESOURCE TRENDS

Volume Increases Abruptly

Since 1952 timber growth has added approximately 50 million cords to Minnesota's forests. During that time about 16 million cords of timber were harvested, leaving a net increase of 34 million cords.

The total volume, 124 million cords in 1962, is increasing by nearly 3½ million cords yearly. Waves of young trees, primarily in the northern counties, are reaching merchantable size in stands previously classed as "restocking." These account for much of the 37-percent increase in volume. Included in the growing stock are 15.5 billion board feet of sawtimber. This total, up 3 billion board feet since 1953, reflects a maturing of the second-growth trees. Growing stock volume increased from 5.0 to 7.3 cords per acre and, in several northern counties, exceeds 9 cords per acre. Statewide, average sawtimber volume per acre changed from 693 to 910 board feet. These trends are shown in the following tabulation:

	1936	1953	1962
Growing stock	*Million cords*		
Softwoods	37.8	35.4	45.7
Hardwoods	42.4	55.1	78.4
Sawtimber	*Million board feet*		
Softwoods	6,300	5,000	6,560
Hardwoods	5,000	7,500	8,959

Hardwood timber volumes have increased with each survey. The upward trend in softwood volume is recent: between 1936 and 1953 softwood volume diminished.

Aspen, spruce, jack pine, and paper birch, in that order, are the most prominent species groups (fig. 1); they include 55 percent of Minnesota's growing stock volume. Aspen accounts for about half of all hardwood volume. Paper birch has moved from the sixth most plentiful species in 1953 to third in 1962, just ahead of black spruce and balsam fir. Jack pine, black spruce, and aspen are favored for pulpwood; aspen and paper birch are potential veneer sources as their stockpile of larger trees expands. Since all four are short-rotation species, larger harvests in the near future seem warranted. Desirable cut estimates for these species rose sharply between surveys.

Aspen maintains its lead in sawtimber volume although it has less than white and red pine combined (fig. 2). Red pine, almost doubling in sawtimber volume, has moved ahead of jack pine to second place among the species. Growing stock and sawtimber volumes accumulated most rapidly in the Central Pine Unit, where the increase exceeds 60 percent in most counties. The increase was large but less uniform in other northern counties. Volumes were lower in southern and western Minnesota, except along the forested edge of the Red River Valley. Some of this decline is attributed to more stringent specifications for sawtimber trees.

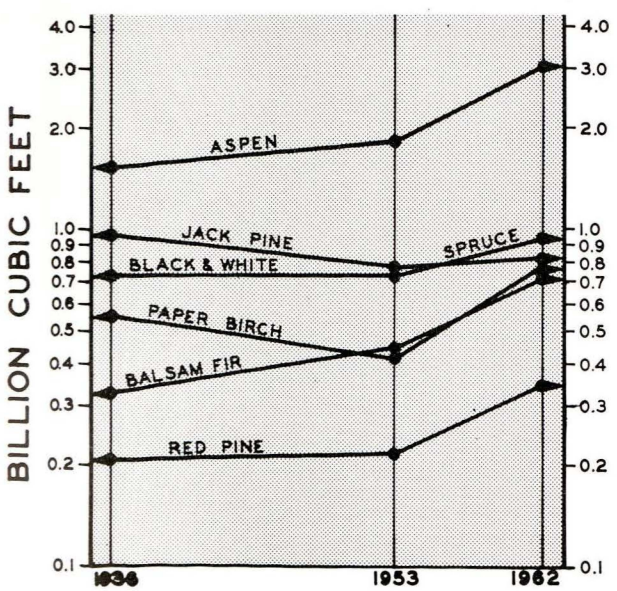


Figure 1.—Changes in growing stock volumes by species—1936, 1953, and 1962.

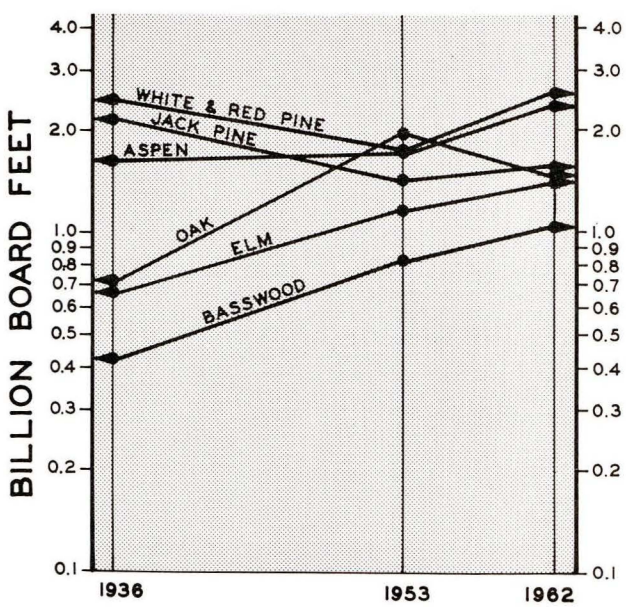


Figure 2.—Changes in sawtimber volumes by species—1936, 1953, and 1962.

Small trees still dominate the timber supply. Less than 10 percent of the 5.7 billion trees (over 3 inches in diameter) in the growing stock exceeds 9 inches d.b.h. (diameter at breast height). About 60 percent of the volume is in trees from 5 to 7 inches in diameter. Basal area averages 66 square feet per acre in trees 3 inches d.b.h. and larger — an average stocking of 330 trees per acre.

Annual Growth Now 5 Million Cords

Annual timber growth has increased since 1936, reflecting more and better stocking with younger and more vigorous trees. The increase in softwood species is overshadowed by the trend in hardwoods; three-fourths of the growth is in hardwood species. Growth statistics indicate there will be a higher proportion of hardwoods in future stands. Sawtimber growth has doubled since 1936 to about 800 million board feet yearly; 37 percent of it is in the softwoods.

Several questions have limited our analysis of growth trends for this Survey. Growth in the 1936 and 1953 Surveys was computed from measurements of tree rings. Mortality was based on counts of dead trees at sample locations. This procedure is inferior to direct remeasurements of sample trees, which was used in this Survey. It is also uncertain what the reduction of nearly one million acres of commercial forest acreage and the shifting of acreages to and from the forest status did to timber volumes previously associated with these acreages. We do know that the previously published growth estimates, interacting with interim estimates of timber cut, will not account for the changes in volume from 1953 to 1962.

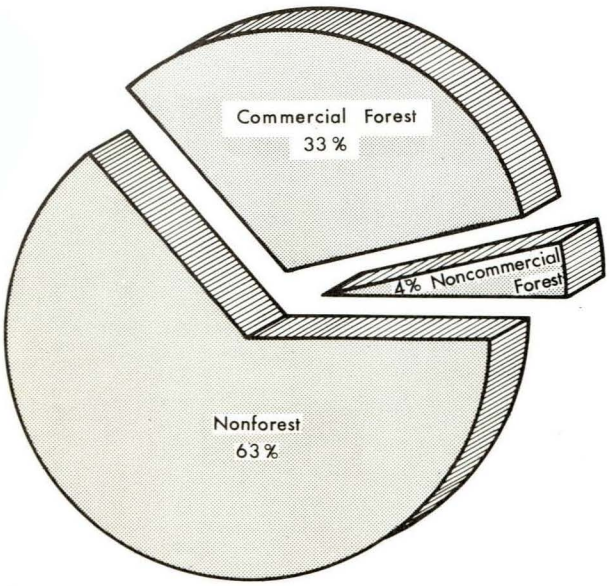


Figure 3.—Proportions of commercial forest, noncommercial forest, and nonforest land in Minnesota.

Aspen growth has increased steadily between succeeding Surveys and now contributes 46 percent of all growth. Red pine and jack pine contribute more than they did in 1953.

High mortality is offsetting growth somewhat. In 1962 nearly 1.8 million cords of timber were killed by disease, fire, insects, and miscellaneous natural causes. This loss is nearly a third as large as the annual net growth. Sawtimber mortality amounted to 17 percent of sawtimber growth. Liquidation of overmature stands (particularly in the Lake Superior Unit), better fire protection, and improved harvesting have reduced these losses since 1953. The risk is increasing, however, since more trees are now on slightly fewer acres.

Forest Area Is Slightly Reduced

Minnesota now has 19 million acres of forest land —3 percent less than 30 years ago (fig. 3). This small decline is due primarily to urbanization, new highway and utility rights-of-way, and other land clearing. These factors have not been offset by natural restocking and tree planting because most of this has occurred on land that is already classed as forest.

The commercial forest area is now estimated at 17.1 million acres, compared with 18.1 million recorded in the First Survey. The 6-percent decrease is deceptive, however. It reflects improved survey procedures, as well as changes in land use. A more objective method of site determination accounts for one-third of the decrease. The rest is associated with the land clearing activities, lake shore developments, and pasturing. A small part of this change resulted from expansion of parks and other reserved recreational areas. The decrease influences timber volume very little, since most of the reclassified area is marginal for growing tree crops or is lightly stocked.

Forest land as a percent of all land declines across Minnesota from the northeast, which is 80-percent forested, to the southwest, where some counties are less than 1 percent forested (fig. 4). The Arrowhead Country near Lake Superior is, in large measure, Minnesota's woodshed. It contains 16 heavily forested counties (see the forest type map on the inside of the back cover).

Most significant of the shifts in forest areas since 1953 is the sharp downturn in nonstocked acreage. More than 1.8 million acres are restocked, as a result of reforestation programs and natural regeneration associated with improved logging and better fire protection. About half a million of these newly stocked

acres primarily support conifers, although over one million acres are newly stocked with hardwoods.

The aspen-birch type now covers a greater acreage than ever before: over one-third of the commercial forest area (fig. 5). More than one-fourth of the aspen-birch type found in the United States occurs in Minnesota.

The pine types have reversed their downward trend as tree planting gave red pine the largest rate of increase in any type since 1953.

The lowland hardwood type group (balsam poplar, cottonwood, and lowland hardwood types) continues to enlarge its acreage. Since 1936 it has expanded in acreage faster than other types, although not as fast as red pine during the fifties.

Of the major types, only jack pine and oak trend downward in acreage occupied.

The large expansion of timber volume is reflected in stand-size trends. Fully half of the commercial forest land supports poletimber stands, compared to one-fourth in 1936 (fig. 6). Sawtimber acreage has steadily increased, although it accounts for only 14 percent of the forest area.

This pattern should be expected in forests whose beginnings were largely in the first two decades of this century. Most hardwood stands originated in the twenties, coinciding with the beginnings of organized fire control. Conifer stands on the average are 40 to 60 years old. This age pattern was caused by the earlier logging of softwoods. The age distribution of softwoods is far less bunched than that of the hardwoods. This young-forest condition is responsible for the large volume increases in the past 10 years and the trend may well continue through at least the next decade. Because the hardwoods are younger, their volumes will probably increase faster (particularly aspen) than will those of softwoods.

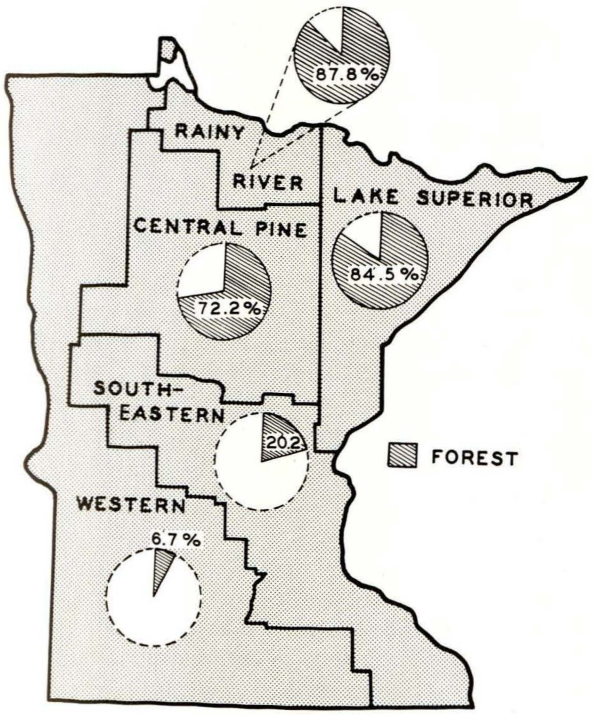


Figure 4.—Percent of forested land by district, 1962.

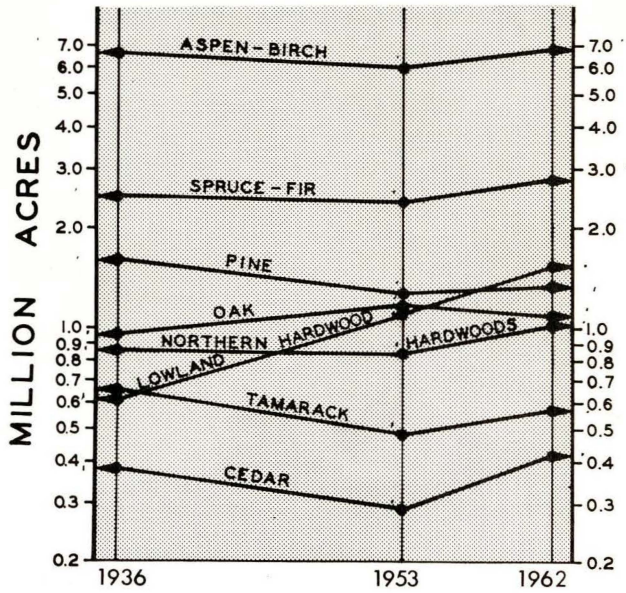


Figure 5.—Changes in commercial forest area by forest type—1936, 1953, and 1962.

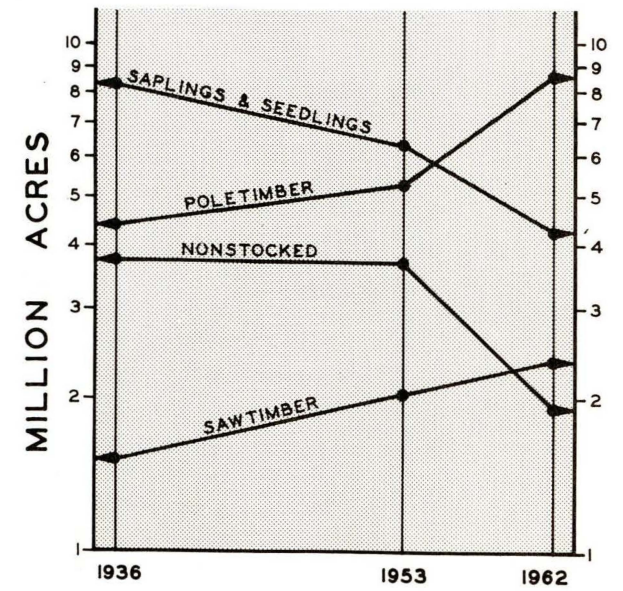


Figure 6.—Changes in commercial forest area by stand-size class—1936, 1953, and 1962.

Ownership Situation Unchanged

In contrast with the wholesale shifting of ownership during the Great Depression era, the relative amounts of Minnesota's commercial forest land in public and private ownership — 56 and 44 percent, respectively — have remained stable during the past 10 years (fig. 7). Within this generalization are many undercurrents of change — mostly localized. Exchanges between the Federal and State governments and between counties and various forest industries or other private owners have tended toward some consolidation of large holdings. A few of the larger ownerships have increased in size through land purchases. Subdividing is increasingly common where lands have substantial recreational value. The impact of these shifts on timber supply is unknown.

Eighty-two percent of Minnesota's commercial forest land is in the three northern Survey units, where 95 percent of the public and forest industry holdings also occur. Farmer and miscellaneous private ownership varies from 15 percent in the Rainy River Unit to 90 percent in the Southeastern Unit. In the 16 northern counties about 45 percent of the commercial forest land is divided nearly equally between county and State ownership. Two-thirds of the forest industry land is in three counties: Koochiching, St. Louis, and Lake.

Federal agencies own nearly 20 percent of the commercial forest land in Minnesota. Most of this is in two National Forests in St. Louis, Lake, Cook, Itasca, Cass, and Beltrami Counties.

Minnesota has more county-owned commercial forest land than any other State in the Union and is second only to Michigan in State forest acreage. However, forest industry owns less here than in Wisconsin, Michigan, or any of the southern States and several northeastern States.

Tree Planting Greens Half-Million Acres

The trees planted in Minnesota during the past 10 years outnumber those planted in all previous years. Altogether, the 609,000 acres planted — largely to pine — represent an impressive forestry achievement, especially when compared to the entire pine acreage in Minnesota: 1.3 million acres.

For years Minnesota planting lagged behind that of adjacent States; but from 1960 to 1963 more trees were planted in Minnesota than in any other State north of the Mason-Dixon line, and in 1963 Minnesota planted 46,000 acres to rank eighth nationwide. In 1964 Michigan and Pennsylvania planted slightly more. Over seven times as many trees were

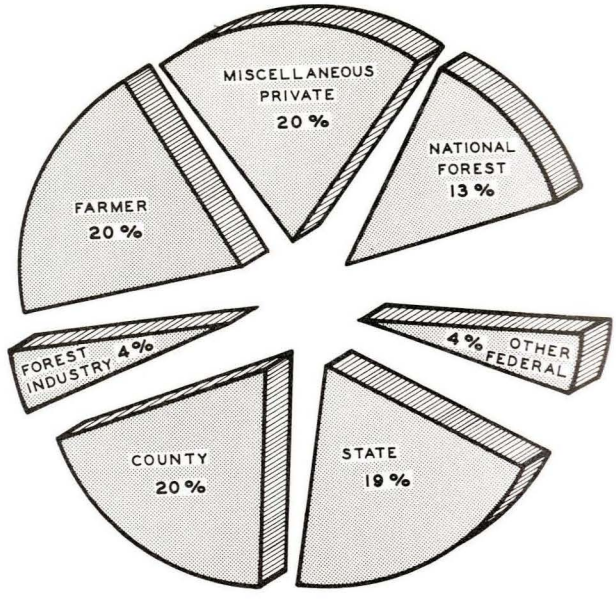


Figure 7.—Who owns Minnesota's commercial forests?

planted in 1964 as in 1950 (fig. 8). About 39 percent of the acreage reforested is private, 31 percent is Federal, and the remaining 30 percent is State and county land.

Most of the plantings have been pine, chiefly red pine, although all native conifers are used. The quantities of particular species planted fluctuate. Today, Minnesotans plant more white and black spruce and balsam fir and somewhat fewer white pine, jack pine, and the popular Christmas tree, Scotch pine.

Additional Data Provide Better Site Statistics

Minnesota's forests extend from the edges of deep, fertile prairie soils in the west and southwest to the shallow, cool forest soils north of Lake Superior. Because of its northerly location, the State has a short growing season. But for the same reason it has a very long growing day during this season. Its forests thrive under competition and sustain high growth with comparatively high numbers of trees per acre. This characteristic produces clean, low-taper trees of high quality.

Glaciation left a jumble of soil types and drainage patterns, across which sites change abruptly and range from very poor to excellent. Each tract of this forest land has an *inherent capacity* to grow wood, governed by such factors as soil quality, aspect, and drainage — one measure of this is site index. However, the *present capacity* to grow wood is limited not

only by the inherent capacity but also by shortcomings in tree stocking, spacing, age, size, and quality. During the Third Minnesota Forest Survey several new kinds of information were collected that better gage all of these features. Even though this information was not collected in previous Surveys, some valuable site trends can be inferred.

Forest site indices across the State average about medium — capable of growing 50-foot trees in as many years. Over one-third of the commercial forests occupy medium sites. Another one-third grow on good or excellent sites, although less than one-tenth of all sites are excellent (growing trees 70 feet tall in 50 years). Half of the good and excellent sites grow aspen.

With full stocking and advanced forestry practices, Minnesota forests could produce about 1 billion cubic feet of commercial wood each year. Net growth is now 41 percent of this potential; likewise, timber cut is just 13 percent of what the forest land is capable of growing.

More Small Trees Decrease Quality

Although site quality intrigues foresters and land managers, tree quality commands the most attention in analysis of the present timber supply and demand situation. As with any raw material, wood with the least variability, lowest cost, and largest bundle of premium characteristics is most sought after. Traditionally, this has come from the large, straight trees with few defects — particularly those species whose lumber seasons well, machines cleanly and smoothly, and finishes easily. In recent years, as the pulp and paper industries eclipsed the solid wood industries, charactertistics such as pulp yield per cord, fiber length, bleachability, and ease of debarking have changed markets and added variety to determinations of timber quality and quality trends.

In this Survey, tree quality was evaluated from volume distributions by log grades and by tree sizes (d.b.h.). Many of the sawtimber trees in the field sample were log-graded. Much of Minnesota's 15.5 billion board feet of sawtimber is of low quality because it is in small trees — often in such species as aspen, jack pine, and paper birch, which rarely reach large diameters.

Loggers have picked over the larger trees among the preferred species for decades, leaving large amounts of second growth that is (due to its small size) grade 3 or poorer, mainly suitable for box and crate material, pallets, dunnage, timbers, and rough lumber. Only 9 percent of the softwood sawtimber and 22 percent of the hardwood sawtimber are in grades 1 and 2, fit for veneer and standard lumber.

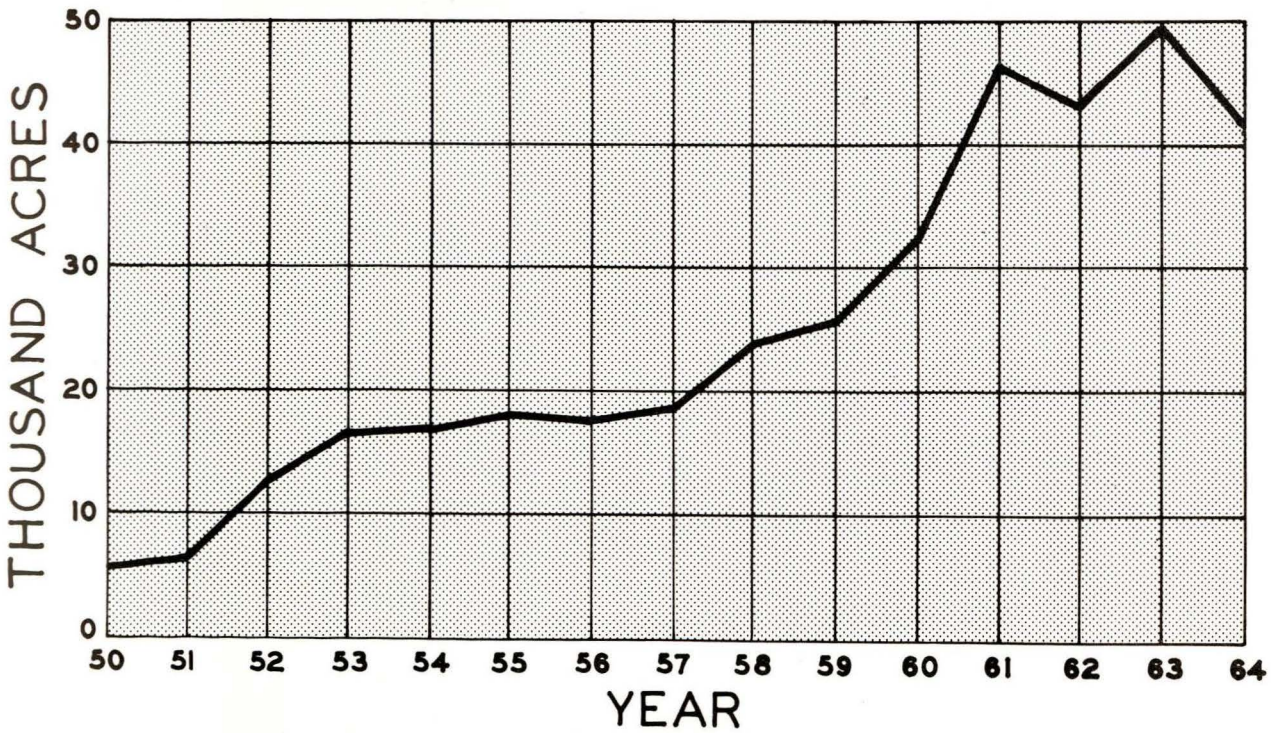


Figure 8.—Area planted to trees in Minnesota, 1950-1964.

The following is a comparison of 1936, 1953, and 1962 diameter distributions of hardwood sawtimber:

Diameter class	*Billion board feet*		
(Inches)	*1936*	*1953*	*1962*
11.0-14.9	3,000	4,626	5,910
15.0-18.9	1,500	1,809	2,071
19.0 and up	1,500	1,064	978
		Percent	
11.0-14.9	48	62	66
15.0-18.9	26	24	23
19.0 and up	26	14	11

As the sawtimber trees less than 15 inches d.b.h. grow, their quality will improve. Medium-sized sawtimber trees are maintaining their relative position. There has been no improvement in relative or absolute volume of very large trees. Lumber and veneer producers are not apt to detect much improvement in the supply of high-quality, large logs during the next decade, except in red pine, even though sawtimber volumes in high-quality smaller trees will accumulate, particularly in aspen and paper birch. The absolute volume in hardwood trees over 20 inches d.b.h. has remained about the same since 1953 (fig. 9).

At present, sawn products are coming from aspen trees and jack pine that were traditionally considered below saw log size. However, an increase of nearly 700 million board feet in aspen sawtimber since 1953 constitutes a rapidly expanding lumber, veneer, or plywood potential.

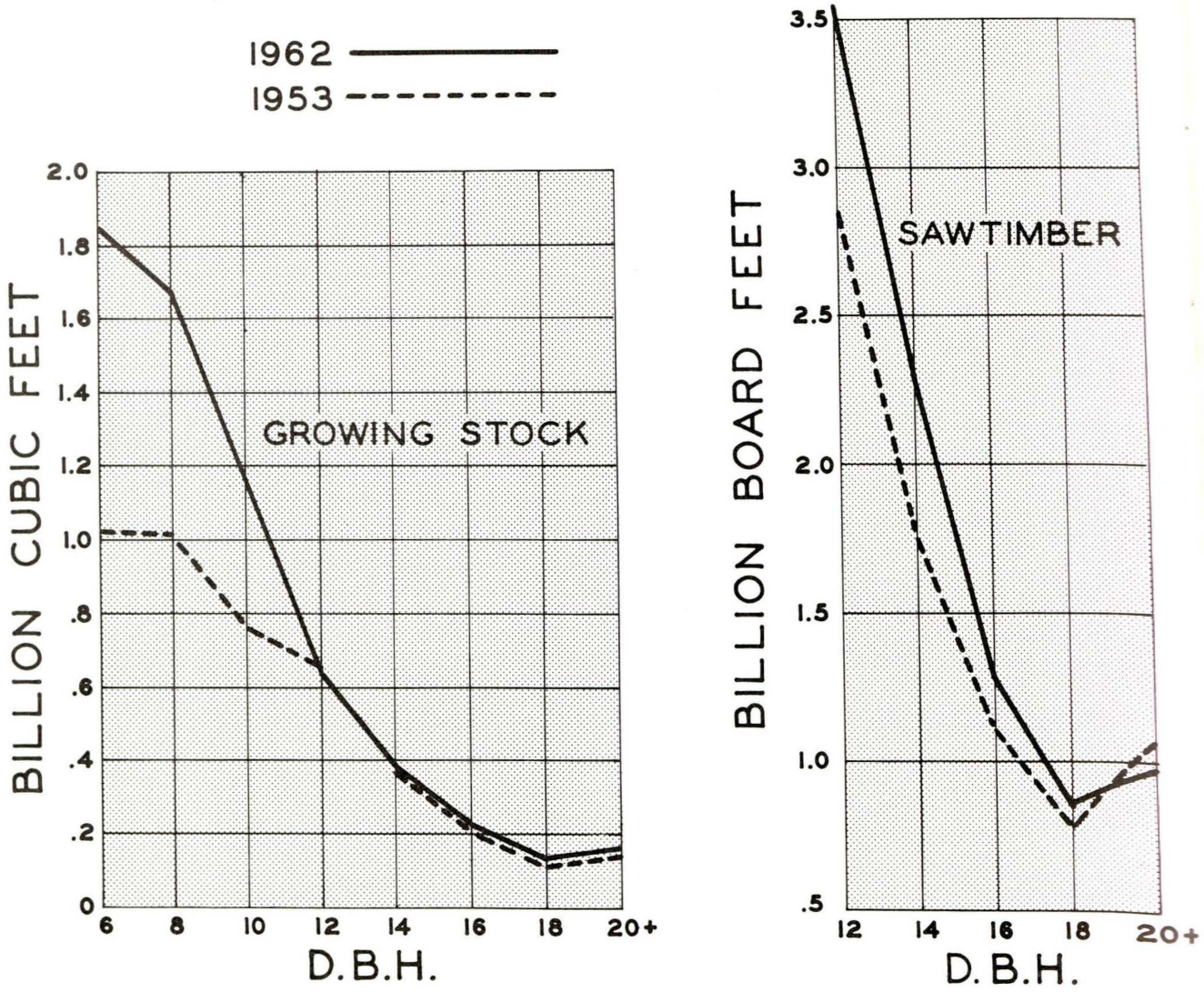


Figure 9.—Volume change in hardwood growing stock and sawtimber, by diameter classes, between 1953 and 1962.

Softwood volume in trees 20 inches d.b.h. and larger has increased slightly. Also, all smaller diameters show volume increases (fig. 10). The softwood sawtimber volume in 15- to 19-inch trees has more than doubled since 1953, with red pine, white pine, white spruce, and jack pine contributing most to the change. Quality will gradually improve as the younger trees grow larger.

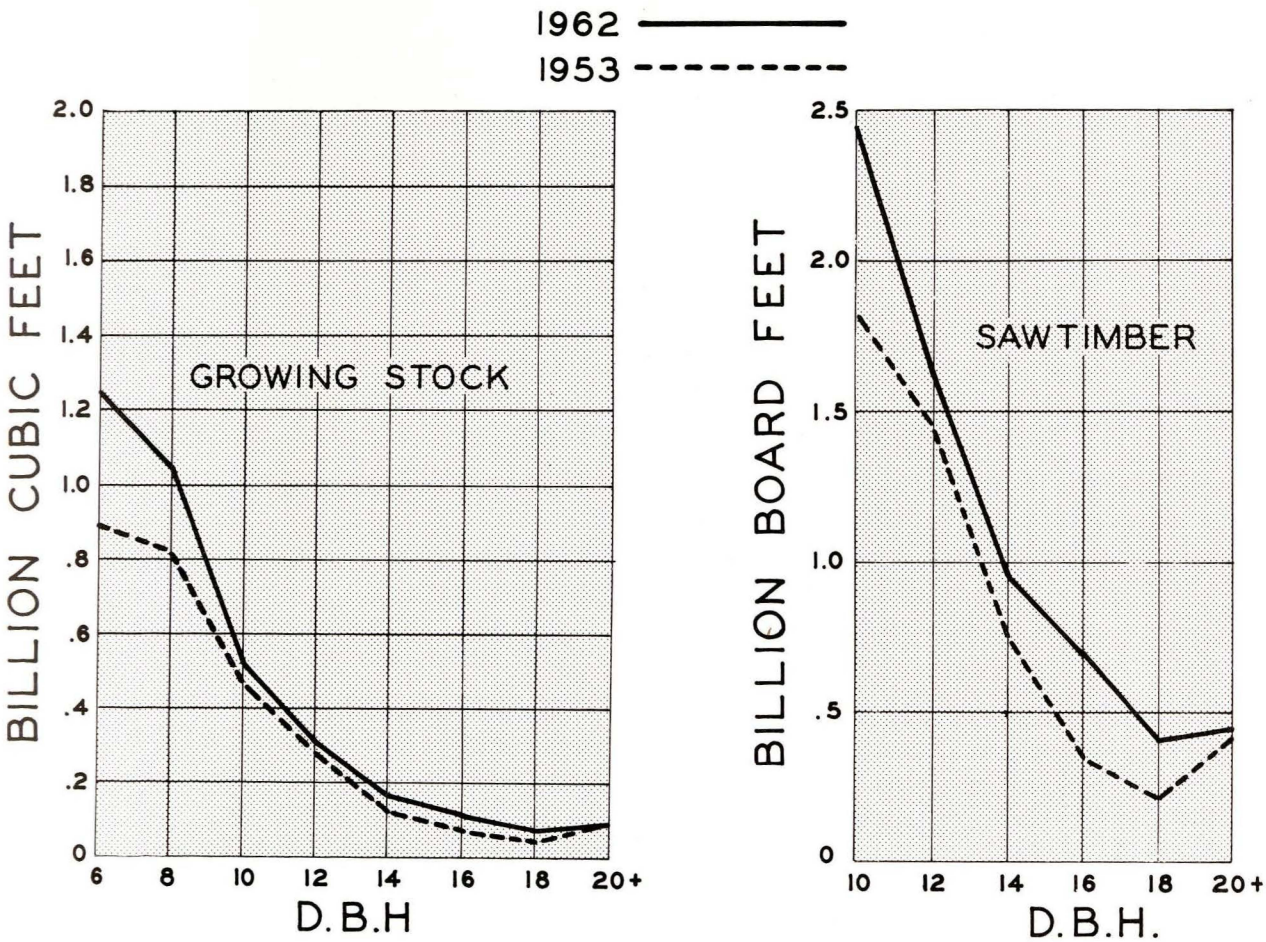


Figure 10.—Volume change in softwood growing stock and sawtimber, by diameter class, between 1953 and 1962.

PRODUCTS TRENDS

In 1958, timber-based activities added $456,000,000 to the State's gross product. This was 5.5 percent of the value of all goods and services produced in Minnesota—a percentage that was nearly identical to timber's share of the national economy.[1]

Timber Creates 58,000 Jobs

About 58,400 Minnesotans — one out of every 22 — were employed in timber-oriented industries in 1958. They were occupied as follows:

	Percent
Forest management	4
Harvesting	14
Primary manufacturing	11
Secondary manufacturing	15
Construction	28
Transportation & marketing	28

Timber-based economic activity merges into a multitude of other industrial, distribution, and marketing activities in the major population centers of southern Minnesota. In northern towns, especially International Falls, Grand Rapids, Cloquet, Bemidji, and Brainerd (as well as numerous smaller ones), wood-using industries contribute conspicuously to local economies. In 1958, pulp and paper industries alone employed over 11,500 people.

The economic impact of Minnesota timber spreads well beyond State borders, too; logs and bolts are shipped in considerable amounts to Wisconsin and other nearby States (fig. 11), as well as in limited quantities to Canada. Wood products from Minnesota find their way into markets throughout the Midwest.

Values, employment, and incomes also accrue from other substantial but nontimber forest products, such as outdoor recreation, fur, fish, and game. Minnesota's tourist and resort business flourishes in localities with spectacular forest scenery. Other nontimber products, such as berries, nuts, greens, maple syrup, tree seeds, and wild rice, support local enterprises. Black spruce Christmas trees from northern Minnesota swamps are sold across the continent.

State Has Over 1,300 Wood-Using Plants

In 1960, 1,345 plants located throughout the State were processing logs and bolts. These include 1,282 sawmills, 9 pulpmills, 7 veneer mills, 6 charcoal plants, 3 cooperage plants, and 38 other plants producing various wooden items such as matches,

[1] *Hair, Dwight. Economic importance of timber in the United States, U.S. Dep. Agr. Misc. Publ. 941. 1963.*

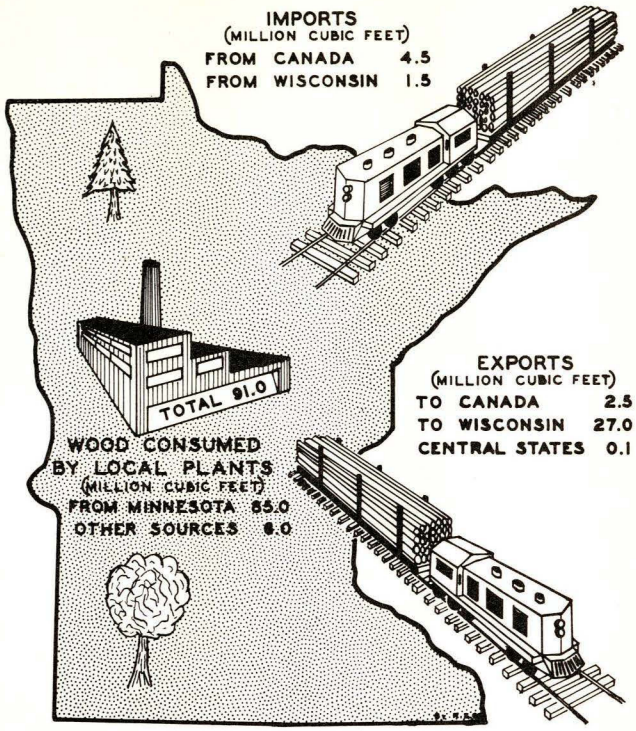


Figure 11.—Timber imports and exports, 1960.

lath, dowels, and rustic fence. Between 1936 and 1953 the number of sawmills increased. It has since declined, but remains above the 1936 mark.

The changing number of primary wood-using firms is shown in the following tabulation:

Kind of plant[1]	*1936*	*1953*	*1960*
Sawmills:			
Large[2]	8	3	1
Medium[3]	20	33	26
Small[4]	1,140	1,351	1,255
Pulpmills	8	9	9
Veneer plants	6	9	7
Excelsior plants	1	0	0
Charcoal plants	0	0	6
Cooperage mills	4	1	3
Misc. plants	56	27	38
All plants	1,243	1,433	1,345

[1] *Idle mills excluded.*

[2] *Annual lumber output in excess of 5 million board feet.*

[3] *Annual lumber output from 1 million to 5 million board feet.*

[4] *Annual lumber output less than 1 million board feet.*

The 162 million cubic feet of wood products cut during 1960 included 51 percent pulpwood, 25 percent fuelwood, 17 percent lumber logs, and 7 percent miscellaneous products. The 1960 production was

81 percent of the 1953 total and 66 percent of the 1936 total.

Nearly all of the decline in total production is attributable to reduced fuelwood use; pulpwood production increased considerably but not enough to offset this loss. Pulpwood output showed its greatest gain during and immediately after World War II. The other products, in total, have maintained a relatively even proportion of the total output.

Pulpwood Industries Expand

Pulpmills are the largest and fastest growing sector of Minnesota's wood-using industries. The 9 pulpmill installations have 12 distinct plants that employed over 11,500 people in 1958. Their capacity has expanded from 1,318 tons per day in 1952 to 2,162 tons per day in 1963 — an annual increase in excess of 6 percent. Most of the increase has been in mills using the semichemical process and those producing defibrated pulp for manufacturing items such as insulating board and hardboard. The pulp industry, which once made mostly spruce pulp for newsprint, now produces pulp for many types of paper, paperboard, and related products. The market for many of these items is nationwide.

Much of the pulpwood cut in Minnesota is consumed by Minnesota mills. Wisconsin mills and, to a much lesser extent, Michigan and Canadian mills also draw part of their pulpwood requirements from Minnesota. However, in recent years a smaller and smaller proportion of the harvest has been sold out of State. In 1963, State consumption amounted to 78 percent of the pulpwood production, although as late as 1949 nearly half was shipped out of the State.

Pulpmill capacity has expanded somewhat faster than pulpwood production, although Minnesota's pulpwood output has risen from 10,000 cords in 1900 to 376,000 cords in 1936 to 1,063,000 cords in 1963. The increased production has been accompanied by important shifts in species used. Between 1936 and 1960, as pulpwood output tripled, aspen replaced spruce as the principal pulpwood species. Aspen output multiplied nearly tenfold (fig. 12), and it is now used extensively for insulating board, hardboard, particleboard, and many types of papers. Pine pulpwood production approached that of spruce during the same period and, if current trends continue, will soon exceed it. Balsam fir contributes significantly to the pulpwood output (about 15 percent in 1960), despite some weakening of its current markets. Comparison of pulpwood production by species for 1936, 1953, 1960, and 1963 is shown in the following tabulation:

Species	*Pulpwood output (thousand cords)*[1] 1936	1953	1960	1963
Aspen	42	270	392	433
Balsam fir	82	163	145	102
Birch, paper	0	2	1	*
Pine	48	194	225	208
Spruce	203	293	256	255
Tamarack	1	13	19	13
Misc. hardwoods	0	2	10	51
Residues	0	0	0	1
All wood material	376	937	1,048	1,063

[1] *Standard cords, roughwood basis.*
* *Less than 500 cords.*

New pulping processes have changed regional dependence on softwoods, shifting demand toward hardwood species. This trend will further reduce Wisconsin use of Minnesota pulpwood, since local hardwood supplies there are nearer the mills. The trend toward increased use of hardwood pulp also has opened markets for hardwood chips from sawmill residue. This has caused some sawmills to add log barkers and chippers in order to move slabs and edgings as pulpwood, although currently this has happened to a greater extent in Wisconsin and Michigan than in Minnesota.

Lumber Output Is Unchanged

Since 1936, lumber production has fluctuated with the general economy. No strong trend is evident, and total output remains about the same. Production reached a peak of 2½ billion board feet in 1902. By 1917 it had slipped below 1 billion board feet. It continued to decline sharply until 1933, when an estimated 80 million board feet were cut. From this low point, production increased to an annual level of 150 to 200 million board feet, where it now stands (fig. 13). In 1936 two-thirds of the lumber production was softwood; by 1953 only half was softwood. As shown in the following tabulation, declining pine and increasing aspen lumber production underlie this change.

Species	*Lumber output (Million board feet)* 1936	1953	1960
White pine	61.1	22.2	21.4
Red pine	23.8	26.2	15.5
Jack pine	28.3	41.2	23.2
Spruce	3.8	3.6	2.8
Balsam fir	1.7	2.6	4.2
Tamarack	1.9	1.0	1.3
Cedar	1.4	2.0	2.1
All softwoods	122.0	98.8	70.5

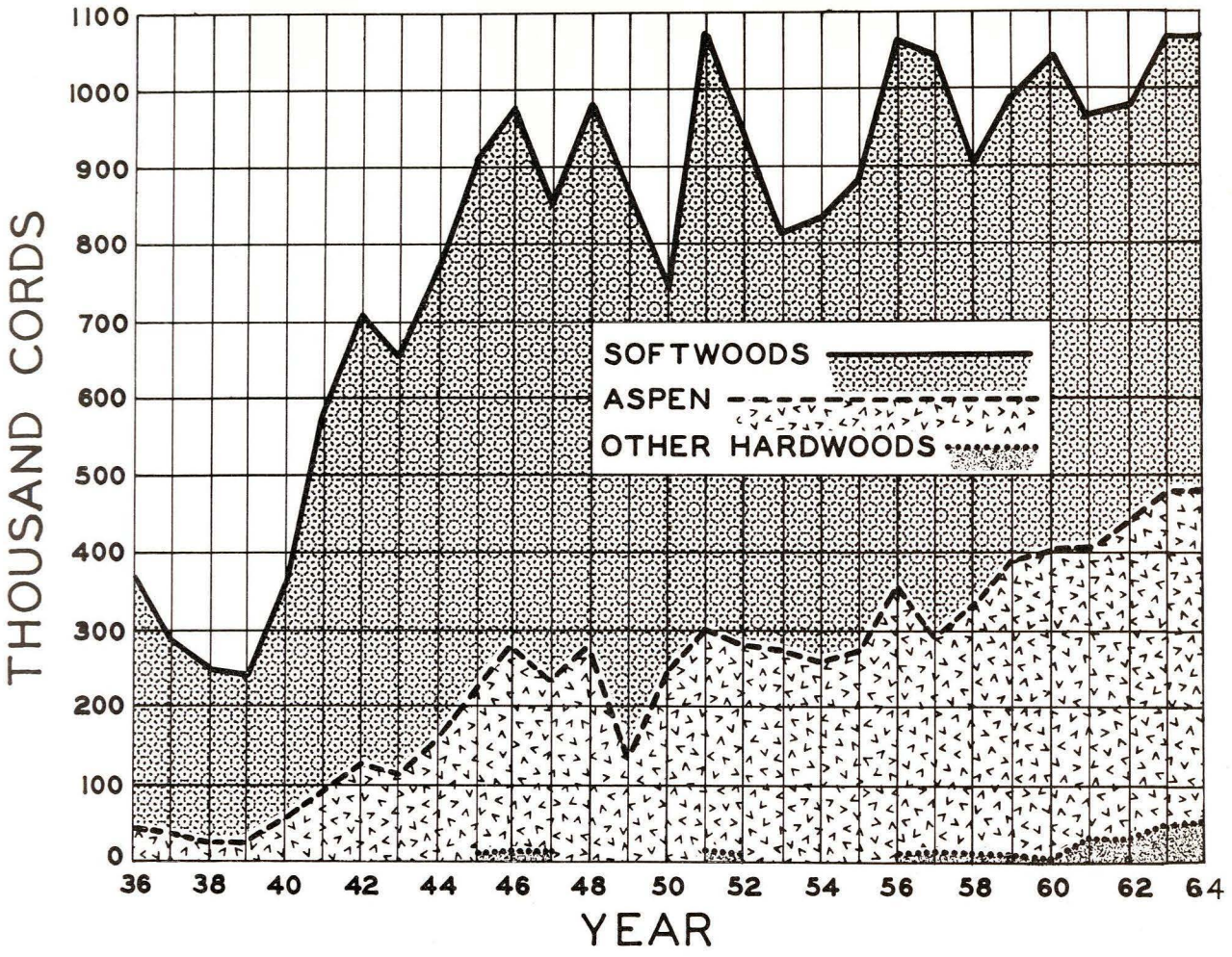


Figure 12.—Trend in pulpwood production by species groups, 1936 to 1963.

Maple	2.7	1.5	2.2
Birch	4.6	5.5	4.2
Basswood	5.3	9.8	8.9
Elm	2.6	9.3	8.9
Oak	7.6	20.9	18.6
Aspen	25.0	38.9	37.6
Cottonwood[1]	9.0	4.4	5.7
Ash	1.0	1.8	4.2
Walnut	*	.2	.2
Other hardwoods	.2	.2	.3
All hardwoods	58.0	92.5	90.8
All species	180.0	191.3	161.3

[1] *Includes balsam poplar.*
* *Less than 500,000 board feet.*

Several modern medium-sized sawmills were constructed recently in northern Minnesota that, while small by comparison with those in more important lumber-producing regions, represent a marked upgrading of equipment.

Miscellaneous Uses Shift

Timber is cut for several products other than pulpwood and lumber. Among these are veneer logs, posts, poles, piling, mine timbers, lath, match stock, and charcoal wood. Also, nearly 5 million Christmas trees are harvested annually in certain northern localities. Other Minnesota industries produce millwork, flooring, pallets, boxes, and treated posts and timbers.

Wood use changes over time as new products are developed and old ones lose favor. Aspen plywood may soon be produced in Minnesota. Wooden post consumption has dropped, due to substitution of steel posts and reduction in farm fencing as farms

decreased in number and increased in size. Wood use by iron mines in northern Minnesota has fallen off, too, in recent years, as deep mines closed and production shifted to open-pit mining. Veneer logs, cooperage logs, and poles have shown moderate production increases since 1936, but piling, lath and shingle bolts, and various kinds of farm timbers are used less.

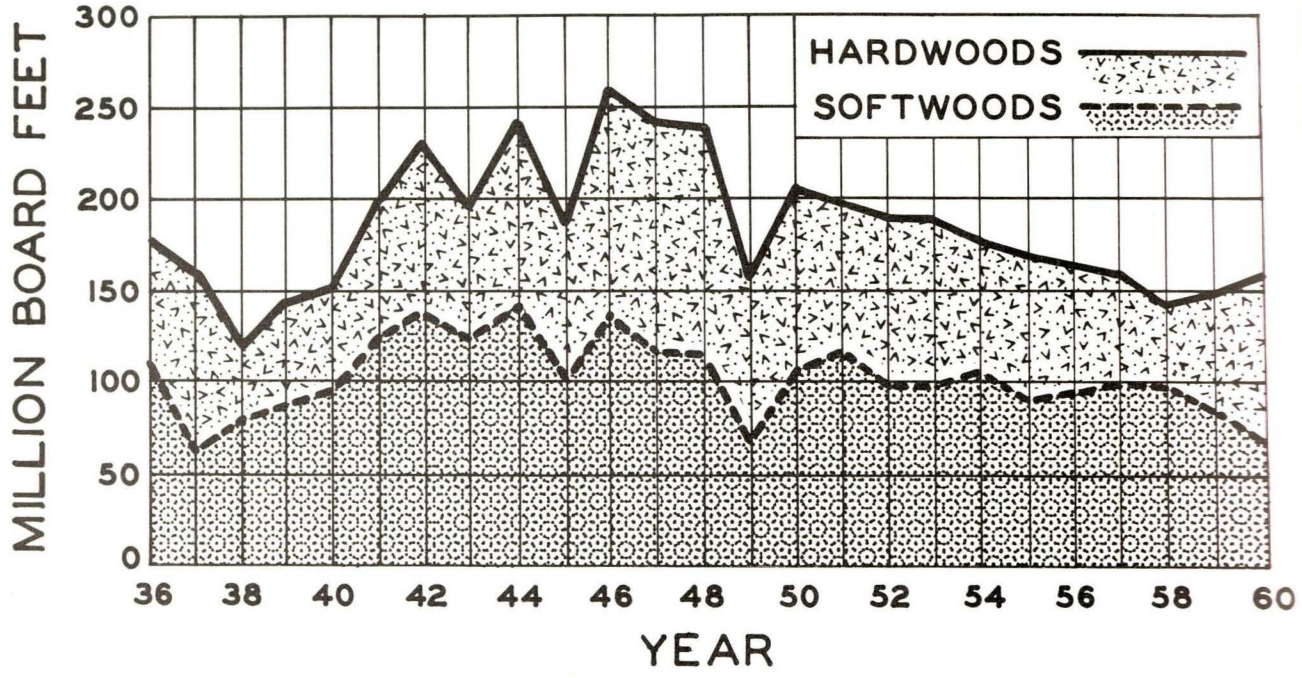
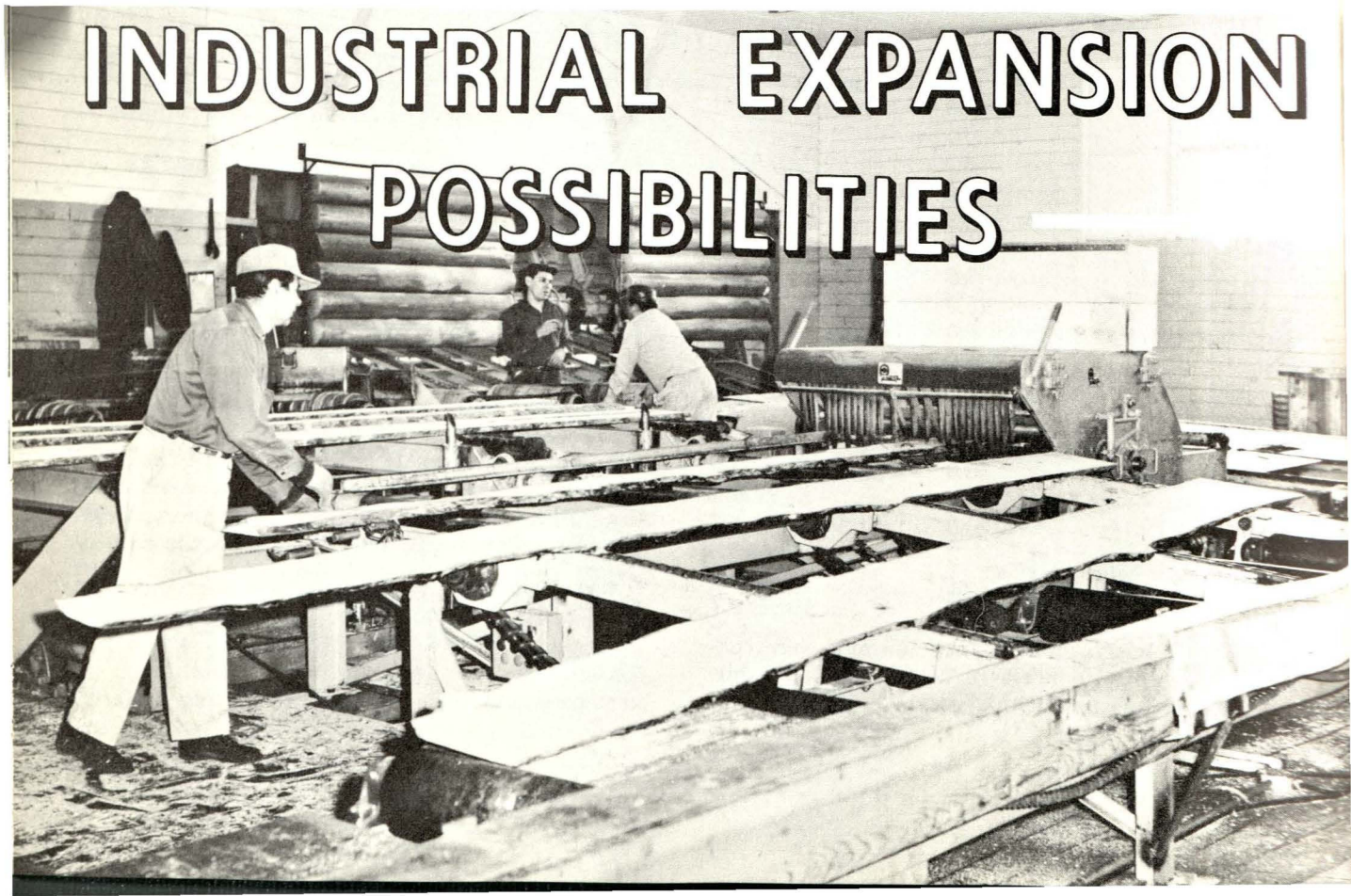


Figure 13.—Hardwood and softwood lumber production, 1936 to 1960.



The timber supply varies with the area of commercial forest and with the interplay of growth, timber cut, and natural losses. To manage timber on a sustained-yield basis, the harvest over a long period cannot exceed growth. Wood crops differ from most crops in that the harvest represents many years' growth. Since timber products are cut primarily from the larger trees, these in turn must be replaced from a chain of maturing smaller and younger trees. Any deficiencies in the age chain in any species can cause supply irregularities — the age chain must therefore be balanced. Since a comparison of cut to growth does not take into account variations within age classes, the concept of desirable cut was formulated. Desirable cut is the level of cutting that will improve or maintain regular age class distributions and bring the whole forest nearer to "full" production. A complete definition is given in the Appendix.

Comparisons of desirable cut with timber cut and with timber growth estimates (figs. 14 and 15) uncover problems of surplus and deficit within the various species.

Overmature softwood stands will cause softwood desirable cut to exceed net growth for the next 10 years. In 18 northern counties there are over 7 million cords of overmature timber (10 or more years older than designated rotation); nearly 4 million cords are softwoods, chiefly jack pine, balsam fir, black spruce, and cedar, with very high mortality and almost no net growth. The bulk of these stands are near the Canadian boundary (in Cook, Lake, St. Louis, and Koochiching Counties) and in Itasca and Beltrami Counties.

The cut of hardwoods, found to be about equal to that of softwoods in the last two Surveys, is now

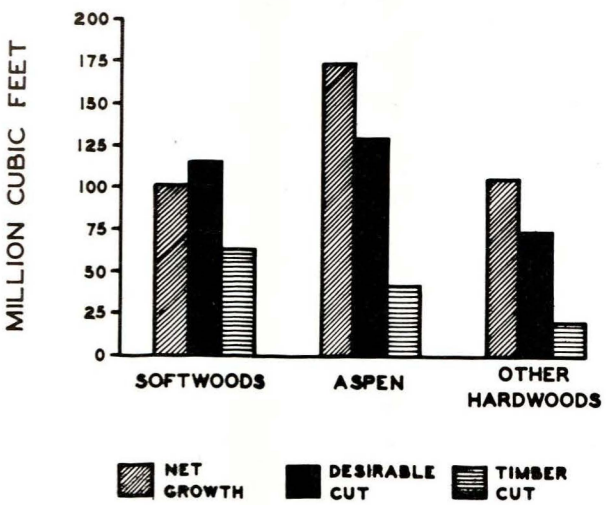


Figure 14.—Net growth, desirable cut, and timber cut of growing stock for softwoods, aspen, and other hardwoods.

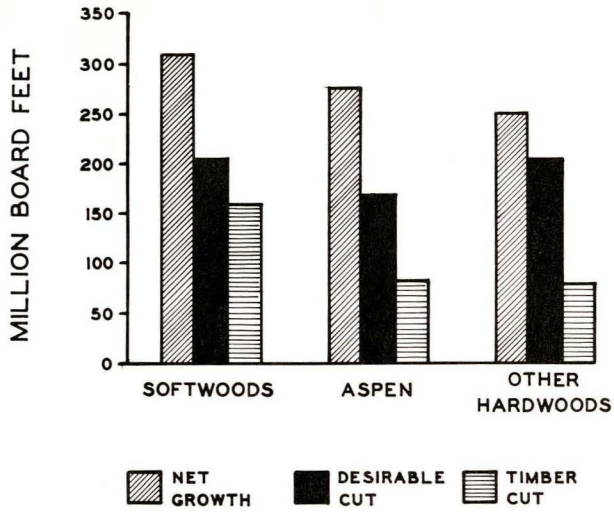


Figure 15.—Net growth, desirable cut, and timber cut of sawtimber for softwoods, aspen, and other hardwoods.

slightly larger than the softwood cut. In 1960, jack pine, spruce, and balsam fir were the principal softwoods cut. Aspen, the principal hardwood, accounted for one-third of the total cut. The total cut of all species in 1960 was 19 percent less than the 1953 cut but still 14 percent more than the 1936 cut. Timber cut, as a percent of timber volume, declined from 2.1 percent in 1953 to 1.2 percent by 1960, to average less than 0.1 cord per acre per year of commercial forest.

Desirable Cut Has Expanded Sharply

The annual desirable cut for the period 1962-1971 in Minnesota is 4 million cords, including 576 million board feet of sawtimber — a sharp expansion since 1936, as is shown below:

	1936	*1953*	*1962*
Growing Stock		*Million Cords*	
Softwoods	.6	1.2	1.5
Hardwoods	1.4	1.9	2.5
Sawtimber		*Million bd. ft.*	
Softwoods	195	223	205
Hardwoods	168	300	371

Only in softwood sawtimber during the last decade has the calculated desirable cut declined. Even this appears to be temporary, for softwood volume is increasing as poletimber grows into sawtimber.

The largest changes in softwood desirable cut are increases in balsam fir and cedar, which are underutilized. Of the hardwoods, aspen, balsam poplar, and paper birch show the most significant increases. However, the 50-million-cubic-foot increase in the aspen desirable cut dwarfs the other changes.

Harvest Lags, Surplus Increases

Timber cut has not kept pace with the rising desirable cut. Growing stock and sawtimber cut in 1936, 1953, and 1960 are shown below:

Growing stock	*1936*	*1953*	*1962*
	Million cords		
Softwoods	0.8	1.0	0.8
Hardwoods	0.6	1.0	0.8
Sawtimber	*Million board feet*		
Softwoods	145	138	160
Hardwoods	79	124	160

Despite rising timber supplies, timber cutting has actually declined since 1953. This trend toward a larger difference between desirable cut and actual cut is especially noticeable in northern Minnesota and, to a lesser extent, in southern Minnesota. Every owner group can harvest more timber, though farmers and miscellaneous private owners are cutting softwood sawtimber in excess of desirable cut. The "surplus," in terms of the physical volume of wood that could be harvested, is largest on county and State forests in northern Minnesota.

Statewide, the annual desirable cut exceeds the actual cut by over 2.4 million cords, revealing a potential harvest 2½ times the current yearly cut. The surplus has more than doubled (more than tripled for softwoods) since 1953, when it amounted to less than 1.2 million cords; the sawtimber surplus is about the same as it was, except that much more of it is now in hardwoods. Comparisons of surpluses in 1953 and 1960 are shown in the following tabulation:

Growing stock	*1953*	*1960*
	Thousand cords	
Softwoods	220	680
Aspen	590	1,100
Other hardwoods	360	660
Sawtimber	*Million board feet*	
Softwoods	85	45
Aspen	90	87
Other hardwoods	87	124

Aspen has the largest surplus (45 percent of the total, over a million cords), followed by balsam fir, paper birch, balsam poplar, jack pine, spruce, cedar, elm, and ash (fig. 16). Four species — aspen, jack pine, balsam fir, and spruce — lead in timber cut volumes. Even with their substantial markets, however, they are growing faster than they are being harvested. Pulpwood surpluses in northeastern and north-central Minnesota suggest industrial expansion possibilities, at least in terms of wood supply.

The decisions of 1965 concerning management of the Boundary Waters Canoe Area on the Superior National Forest will change the timber supply picture somewhat in St. Louis, Lake, and Cook Counties. Secretary of Agriculture Freeman announced that 150,000 acres were to be added to the no-cut reservation immediately and another 100,000 would be gradually included over a 10-year period. The exact boundaries of the revised no-cut zone are not established; hence, no adjustments were made in the statistics for this report.

Despite huge aspen surplus increases, there has been no increase in the cut. Rapid growth and extensive acreages of fairly young and well-stocked aspen stands may create an even larger surplus, unless use is greatly intensified. The present aspen sawtimber surplus of 87 million board feet suggests an untapped potential for sawn or sliced products. As most of the growing stock is on the verge of becoming sawtimber, this part of the aspen surplus may grow larger.

Even now, the aspen sawtimber surplus is the largest among all species, followed by elm, balsam poplar, balsam fir, cedar, jack pine, ash, paper birch, and hard maple (fig. 17). These are the same species that have surpluses in growing stock, except that hard maple has replaced spruce.

The sawtimber cut is about 260 million board feet below desirable cut, almost the same as in 1953.

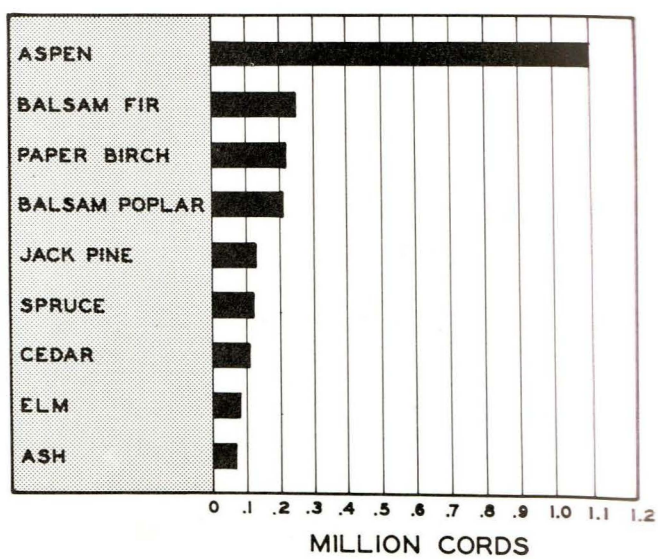


Figure 16.—Annual surpluses of important species. Larger markets needed soon to harvest desirable cut.

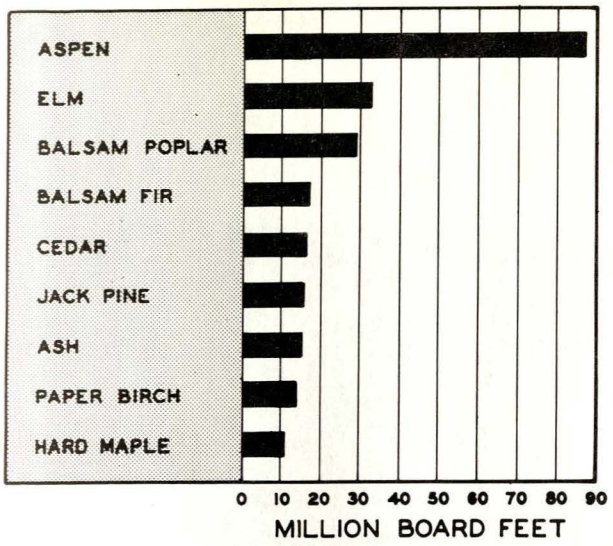


Figure 17.—Annual sawtimber surpluses for important species.

This apparent stability, however, conceals increases in desirable and actual cut of about 60 million board feet each. Also, the overall composition of the surplus has changed. The softwood sawtimber decline of nearly 50 percent was offset by increased hardwood surpluses.

The sawtimber surplus is more widely distributed and less concentrated than the surplus of growing stock. The surplus in softwood sawtimber in the Lake Superior Unit amounts to 30 million board feet. No other unit has as much as 10 million feet surplus softwood timber. The Lake Superior Unit also has 70 million board feet of surplus hardwood sawtimber, including 50 million feet of aspen. The Central Pine Unit could cut about 75 million more board feet of hardwood sawtimber each year, including 30 million feet of aspen.

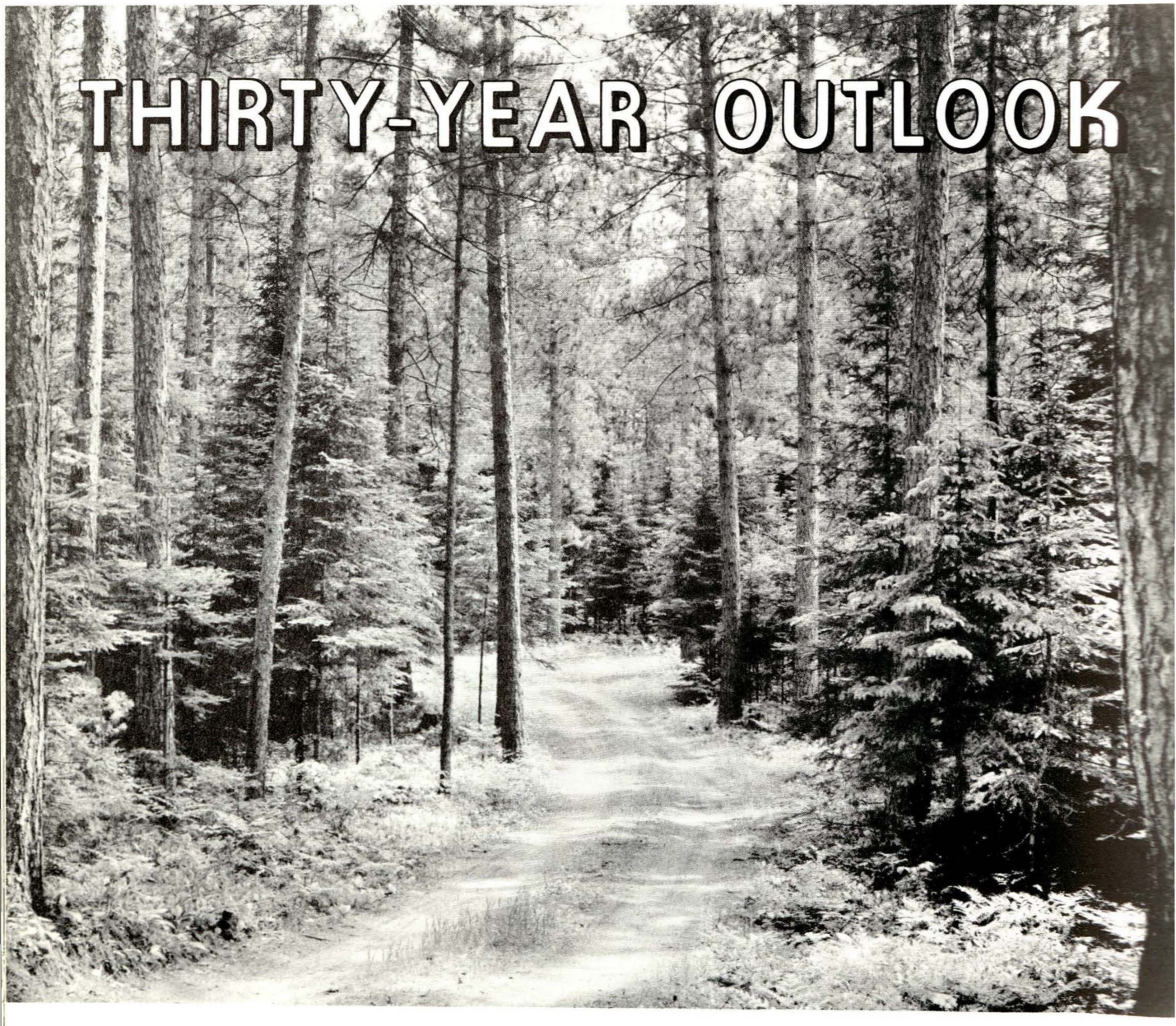
Economic Factors Limit Actual Cut

Actual cut depends upon interactions between the production costs incurred by wood-using industries and the prices they receive for their products. Whether much of the increasing surplus can be used in the near future hinges on possible economic changes that would suggest profitable opportunities and thus would encourage wood processors to expand their operations in Minnesota. Improvements in timber supply alone may not lead to a larger timber cut, although the expanding timber supply generates a positive pressure by encouraging industries to install larger capacity mills that operate more efficiently.

Minnesota's timber supply is widely dispersed in relatively low volumes, generally in the range of 5 to 25 cords per acre. Conversely, the pulpmills and, to a somewhat lesser degree, other major timber processors are concentrated at relatively few locations. The latter are mostly small operators who use only certain types of raw materials. These conditions have tended to create zones, remote from mills, where timber is cut only in peak demand periods. The situation is further complicated by timber supplies in several species that have very limited use under present conditions.

The surplus, therefore, generally lacks something in terms of location, species, or size, which makes it undesirable for existing wood-using industries at present levels of consumption.

Transportation and market patterns, too, have been comparatively disadvantageous for wood-using industries in Minnesota. The timber is largely to the north and northeast — much of it tucked around the corner of westwardly protruding Lake Superior — some distance from major Midwestern population centers. While markets are located to the south, the major railroads transect Minnesota east and west. Interline rates thus penalize product movements between source and markets. The St. Lawrence Seaway and planned interstate highways may diminish this disadvantage.


THIRTY-YEAR OUTLOOK

Larger Timber Resource Projected

The past 30 years have shown a basis for further expansion of timber supplies in the next 30 years. Minnesota's future timber situation will be affected by various factors: the physical timber supply, new harvest and transportation developments, a growing population, new wood products, improved processes, and different distributing and marketing channels.

The location of the timber supply is subject to changing land use patterns. Even as reforestation adds productive forest acreage, other lands are diverted to nontimber uses. During the last 25 years timber supplies have been increased by fire protection, insect and disease control, and improved cutting practices. The stands are becoming denser and older. Many of the better planting sites are now reforested. Future improvements will depend upon decisions to make further investments in forest management.

Recent timber volume trends indicate larger future supplies. By 1992 growing stock volume is expected to increase about 75 percent, net growth about 15 percent, and timber cut 60 percent over 1962. Sawtimber volume should nearly triple. In general, the forests will be better stocked and more productive than they are now. Hardwood cubic-foot volume will double, but for softwoods only a 10-percent increase is anticipated.

Timber growth and cut have been projected for 1972, 1982, and 1992. These projections assume that: (1) annual timber products output in Minnesota will rise along with estimated increases in population and income; (2) wood will maintain its relative position in the national economy; (3) tree planting will continue at the rate indicated by recent trends; and (4) timber utilization will improve, i.e., more of each tree harvested will be converted into useful products. The projections are also predicated upon expected increases in industrial demand for timber products, continuing reforestation at a high level, natural losses as revealed by past trends, and other changes that will lead to a more productive forest and, hence, a higher desirable cut.

Resource projections are inherently speculative, since the future forest resource situation depends on numerous man-directed factors. These projections are not forecasts, for as they reveal potential supply problems and opportunities they also serve to trigger needed modifications. Timber resource projections amplify trends, indicating potential supply limitations, and thus give resource planners and timber users time to adjust future supplies to specified needs. Minnesota's forests can produce far more wood than is projected during the next 30 years. New knowledge from current research will certainly raise this capacity.

The projections are based on present diameter distributions and recent studies of diameter growth, tree mortality, and timber cut. They indicate that Minnesota's forests will have larger percentages of aspen and hardwood volume in 1992 than in 1962.

The physical supply of timber will increase, along with cut and mortality. Future softwood volumes will be mostly in trees 8 to 14 inches d.b.h., with fewer very large and very small trees and a slight but gradual reduction in growth.

Aspen seems likely to continue its recent expansion of volume. Annual aspen growth is increasing slowly but steadily. By the year 2000 it will be nearly 10 percent more than it is today. The anticipated increase in aspen timber cut from 43.3 million cubic feet to 54.4 will be less than losses due to mortality. Aspen sawtimber volume should more than triple. By 1972 the total aspen volume will be greater than that of all softwoods or all other hardwoods.

The projections indicate a substantial increase of hardwood volumes in all sizes except trees with d.b.h. larger than 22 inches. By 1972, hardwoods other than aspen will have more volume than softwoods. Average timber volumes during the next two decades will increase from the present 7.3 cords per acre to nearly 11 cords.

Marketing Importance Grows

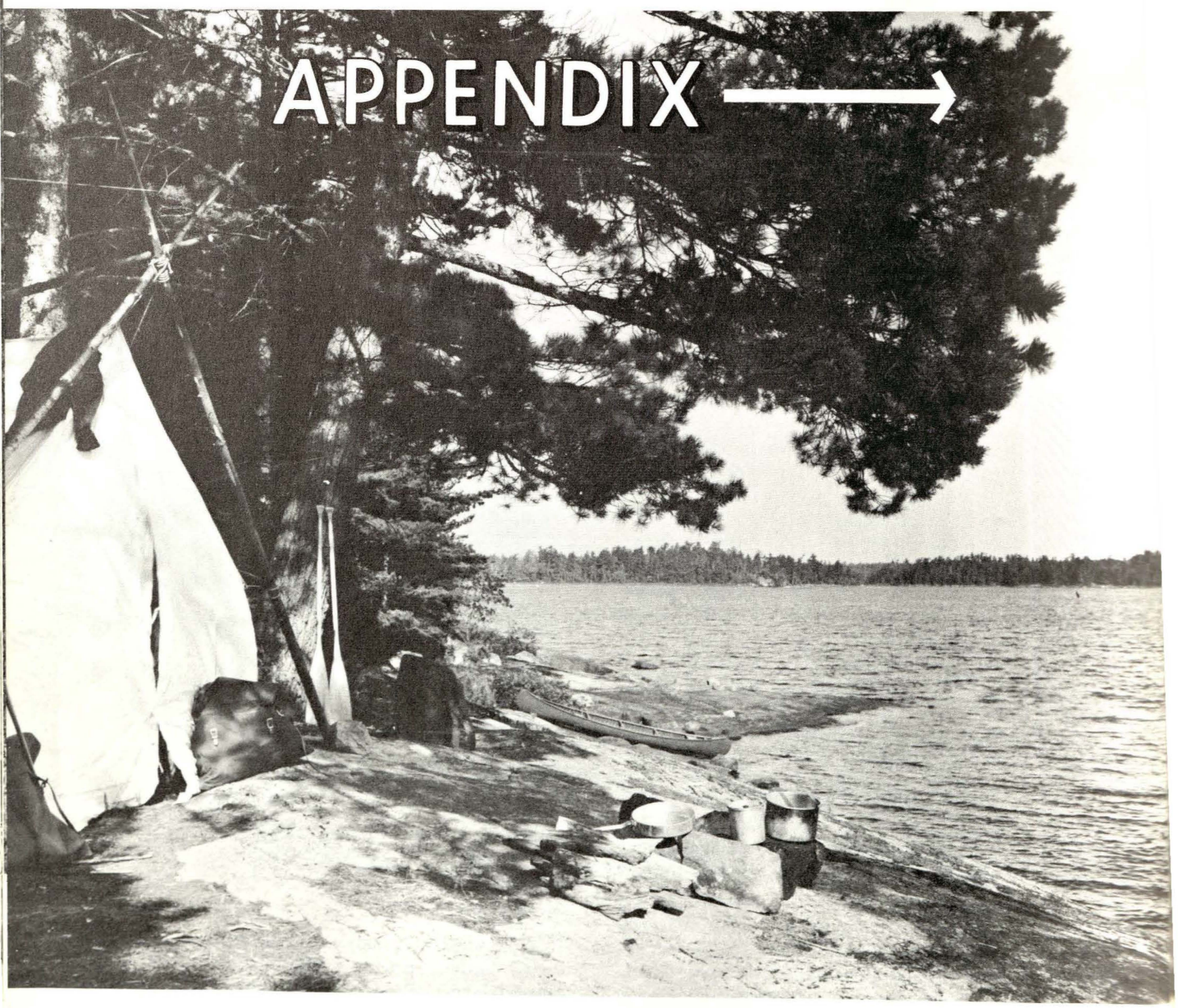
With the timber supply expanding, with tree stocking moving toward capacity levels, and with a large sector of the forest approaching maturity, our main attention can shift somewhat from timber supply to timber industry and marketing problems. The payoff for a resource comes with use.

A new era of mechanized harvest began with the gasoline-powered chain saw, but such improvements still lag well behind those of many other industries. More mechanization seems certain; whole-tree logging, timber harvesting combines, hydraulic loading and lifting devices, portable log debarkers, chippers, versatile and swift rubber-tired skidders, and even rail cars built to meet log transportation specifications are slowly changing the character and economics of timber harvesting.

Affecting wood manufacturing are new dense hardwood pulping processes and new products, such as particleboard. Production of aspen plywood, other small-log veneer, and wood chips for foreign markets are other possibilities under study.

Minnesota now exports annually 375,000 cords of wood — mainly to Wisconsin pulpmills, but also to Michigan, several Central States, and Canada. Changing timber supplies may affect these markets, as may industrial expansion in Minnesota. Trends in exports, product use, and capacity of wood-using industries throughout the region will affect the complexion of wood-based industrial development. Since total wood supply will increase faster than log quality can improve, industries that use wood fiber or particles will have more abundant sources of raw material before lumber and veneer producers note greater supplies of high-quality logs.

Defining and developing additional markets for an increasing forest resource offers Minnesota an economic challenge, now that the rebuilding of the once largely depleted forests is well on the way to being realized.



Accuracy of Survey

Estimates of forest area and timber volume are subject to two kinds of error: sampling errors and human errors (mistakes in judgment, recording, calculation, and compilation).

Sampling errors, which are measurable, are reduced to a minimum through the sampling design and the sample size. Nonsampling errors are not measurable, but are minimized through close supervision and adequate training of employees and through rechecking of all work phases.

Substantial contributions from cooperating agencies and companies permitted the sample accuracy in Minnesota to greatly exceed minimum national standards. The sampling error is ± 0.2 percent for total forest area and ± 0.9 percent for total timber volume. This means that two out of three duplicate surveys would find the forest area within these percentages of the State totals reported here. As these totals are subdivided into detailed statistics — forest type, species, tree diameter—the sampling error increases and is greatest for the smallest items.

The following tabulation illustrates the estimated sampling error for a range of acres and volumes:

Sampling error (Percent ±)	*Forest area (Thousand acres)*	*Timber volume (Million cu. ft.)*
0.2	17,062.0	—
.9	1,000.0	9,801.8
1.0	902.0	8,830.7
2.0	225.5	2,207.7
2.97	102.3	1,000.0
3.0	100.2	981.2
4.0	56.4	551.9
5.0	36.1	353.2
10.0	9.0	88.3
15.0	4.0	39.2
20.0	2.3	22.1
40.0	.6	5.5

Survey Procedure

Forest area, volume, and growth statistics were compiled from sample survey data. Area and volume estimates from the Superior and Chippewa National Forests were supplied by the Eastern Region, U.S. Forest Service. The Minnesota Department of Conservation, Minnesota and Ontario Paper Company, Koochiching County, and Kimberly-Clark Corporation provided data for their ownerships. In general, this information was obtained from aerial photographs and from sample plots examined on the ground.

The Forest Survey of lands not covered by these cooperators employed a three-stage sampling procedure. First, many points were examined on aerial photographs to determine the proportions of forest and nonforest area. These proportions, multiplied by gross land area, produced the basic area estimates. Then a subsample of the forest points was further analyzed and photomeasured to estimate forest type, stand-size, and density. Finally, a subsample of these photo plots was systematically selected and measured on the ground to check photo classifications.

Ownership of commercial forest land in northern Minnesota was compiled from complete tabulations of official county ownership records. In southern Minnesota, ownership was based on the field sample. Timber volume was based on tree measurements. Growth and mortality were calculated from remeasurement of permanent plots.

The information thus gathered was edited, coded, and punched for computing and tabulating. These figures were combined with similar estimates furnished by cooperators to prepare the area, volume, and growth tables presented in this report.

Timber cut and forest products output were estimated for 1960 from data in forest industries production reports, stump counts from forest inventory plots, cutting records from industrial and public owners, and utilization factors based on a logging residue study.

Definition of Terms

Land-Use Classes

Land area.— The area of dry land and land temporarily or partially covered by water such as marshes, swamps, and flood plains, streams, sloughs less than one-eighth mile wide, and lakes, reservoirs, and ponds smaller than 40 acres.

Forest land.— Land now or formerly at least 10-percent stocked by forest trees of any size and not currently developed for nonforest use. Excludes urban or thickly settled residential and resort areas, city parks, orchards, farmsteads, improved roads, or lands developed and maintained for nonforest use by fencing, seeding, etc. The minimum forest area classified was one acre. Roadside, streamside, and shelter-belt strips of timber at least 120 feet wide qualified as forest land. Unimproved roads and trails, streams, and clearings less than 120 feet wide in forest land were also included.

Commercial forest land.— Forest land which does or can produce crops of industrial wood and which is not withdrawn from timber utilization by statute or administrative regulation.

Noncommercial forest land.— Unproductive forest land incapable of yielding crops of industrial wood, and productive public forest land withdrawn from commercial timber use through statute or administrative regulation.

Forest Types

A classification of forest land based upon the species forming a plurality of stocking. Stocking is based on the area occupied by the present tree cover. This differs from the 1947 Lake States standards, which characterized a type upon the species forming a plurality of the volume in the stand. The following types were recognized in the Minnesota Survey:

White pine. — Forests in which eastern white pine comprises a plurality of the stocking. (Common associates include red pine, jack pine, aspen, birch, and maple.)

Red pine.— Forests in which red pine (Norway) comprises a plurality of the stocking. (Common associates include eastern white pine, jack pine, aspen, birch, and maple.)

Jack pine.— Forests in which jack pine comprises a plurality of the stocking. (Common associates include eastern white pine, red pine, aspen, birch, and maple.)

Balsam fir.— Forests in which balsam fir comprises a plurality of the stocking. (Common associates include white spruce, aspen, maple, birch, white-cedar, and tamarack.)

White spruce.— Forests in which white spruce comprises a plurality of the stocking. (Common associates include balsam fir, aspen, maple, birch, white-cedar, and tamarack.)

Black spruce.— Forests in which black spruce comprises a plurality of the stocking. (Common associates include tamarack and white-cedar.)

Tamarack.— Forests in which tamarack comprises a plurality of the stocking. (Common associates include black spruce and white-cedar.)

White-cedar.—Forests in which white-cedar comprises a plurality of the stocking. (Common associates include tamarack and black spruce.)

Northern hardwoods.— Forests in which maple, yellow birch, and basswood, singly or in combination, comprise a plurality of the stocking. (Common associates include elm and white pine.)

Oak.— Forests in which upland oaks, singly or in combination, comprise a plurality of the stocking. (Common associates include elm, maple, and aspen.)

Lowland Hardwoods.—Forests in which elm, and ash, singly or in combination, comprise a plurality of stocking. (Common associates include cottonwood, maple, and balsam poplar.)

Balsam poplar.— Forests in which balsam poplar comprises a plurality of stocking. (Common associates include elm, ash, maple, and cottonwood.)

Aspen.— Forests in which quaking or bigtooth aspen comprises a plurality of stocking. (Common associates include balsam poplar, balsam fir, and paper birch.)

Paper birch.— Forests in which paper birch comprises a plurality of the stocking. (Common associates include maple, aspen, and balsam fir.)

Grass and upland brush.— Productive uplands supporting grass and/or upland shrubs (hazel, sumac, mountain maple, juniper, etc.), from which forest trees have been removed to less than 10 percent stocking. Includes permanently abandoned fields but not prairie grass areas where trees never existed.

Lowland brush.— Productive lowland supporting lowland shrubs (alder, willow, dogwood, Labrador-tea, etc.), from which forest trees have been removed to less than 10 percent stocking.

Ownership Classes

National Forest.— Federally owned land within National Forest boundaries and other lands under the administration of the Forest Service.

Indian.— Tribal lands held in fee by the Federal Government but administered for Indian tribal groups and Indian trust allotments.

Other Federal.— Federal lands, other than National Forest or Indian, in military reservations, wildlife refuges, etc.

State.— Lands States own or have leased for more than 50 years; State Forests, etc.

County and municipal.— Lands counties or municipalities own or have leased for more than 50 years.

Pulp and paper companies.— Fee simple lands of pulp and paper companies; excludes leased lands.

Lumber companies.— Fee simple lands of lumber producers of 100,000 board feet per year; excludes leased lands.

Other wood-using industries.— Lands owned by all primary and secondary wood-using industries: sawmills, veneer plants, handle mills, furniture factories, etc.

Farmer owned.— Lands owned by operators of farms, retired farmers, or wives of farmers. A farm must include 10 or more acres and must yield $50 or more annually from agricultural products or, if less than 10 acres, the yield must be at least $250 annually. Forest land owned by a farmer is classified as farmer-owned, whether or not the tract contains an agricultural operation, unless the owner operates a forest industry. Lands leased by farm operators from such owners as railroads, States, and pulp companies are not considered to be farmer-owned.

Miscellaneous private.— Privately owned lands other than forest-industry or farmer-owned.

Stand-Size Classes

Stand-size class is based on the predominant size of timber present— sawtimber, poletimber, or saplings and seedlings.

Sawtimber stands.— At least 10-percent stocked with growing stock trees and with a plurality of stocking by sawtimber trees.

Poletimber stands.— At least 10-percent stocked with growing stock trees and with a plurality of stocking by poletimber trees.

Sapling and seedling stands.— At least 10-percent stocked with growing stock trees and with a plurality of stocking by saplings and seedlings.

Nonstocked.— Commercial forest land less than 10-percent stocked with growing stock trees.

Area Condition

Area condition classes on commercial forest land are based upon levels of desirable stocking and other conditions affecting current and prospective tree growth.

A desirable tree is a healthy dominant or co-dominant tree with (1) a crown more than one-third filled with foliage of good color and normal size; (2) no apparent physical weaknesses, pathogens, or insects present that are likely to kill or seriously deteriorate the tree within 10 years; (3) less than 10 percent loss of scale; (4) prospective or immediate yield of at least one grade 2 saw log or two 100-inch sticks of pulpwood. Any tree of commercial species meeting the above specifications was classed desirable if it was 3 inches d.b.h. or larger; if smaller, it had to be of a species suitable for the type.

Using these qualifications, the following condition classes were established:

Desirable.—Areas 70-percent or more stocked with desirable trees.

Moderate and favorable.— Areas 40- to 70-percent stocked with desirable trees, with 30 percent or less of the remaining area controlled by other trees, inhibiting vegetation, or surface conditions that will prevent occupancy by desirable trees.

Moderate and unfavorable.— Areas 40- to 70-percent stocked with desirable trees, with more than 30 percent of the remaining area controlled by other trees, inhibiting vegetation, or surface conditions that will prevent occupancy by desirable trees.

Poor but favorable.— Areas less than 40-percent stocked with desirable trees, with adequate seed source and seedbed favorable for natural restocking.

Poor and unfavorable.— Areas less than 40-percent stocked with desirable trees, with inadequate seed source or seedbed unfavorable to natural regeneration.

Site Classes

Site classifications indicate quality of forest land for raising timber products. Site index is the expected height of a free-growing tree at age 50. These classifications are derived from age and total height measurements of a dominant tree in the main stand on each plot. The site indices for this Survey were grouped by type into excellent, good, medium, or poor, according to the ranges in table A.

Table A.— *Guide for using site classes for Third Minnesota Forest Survey, by types, 1960-1962*

Forest type	Index for:			
	Excellent site	Good site	Medium site	Poor site
White pine	76+	66-75	56-65	45-55
Red pine	66+	57-65	47-56	35-46
Jack pine	73+	60-72	47-59	34-46
Balsam fir	61+	51-60	41-50	30-40
White spruce	66+	56-65	46-55	35-45
Black spruce	43+	36-42	30-35	23-29
Tamarack	58+	48-57	38-47	27-37
Cedar	46+	36-45	26-35	20-25
Northern hardwoods	71+	61-70	51-60	40-50
Oak	71+	61-70	51-60	40-50
Lowland hardwoods	71+	61-70	51-60	40-50
Balsam poplar	76+	66-75	56-65	45-55
Aspen	76+	66-75	56-65	45-55
Paper birch	66+	56-65	48-55	38-47

Stand-Age Classifications

Stand-age classifications are determined from the age of the main stand for both even- and uneven-aged stands.

Tree Classifications

Sawtimber trees.— Live trees of commercial species at least 9.0 inches d.b.h. for softwoods and 11.0 inches d.b.h. for hardwoods, containing at least one merchantable saw log.

Poletimber trees.— Live trees with good vigor and form of commercial species 5.0 to 8.9 inches d.b.h. for softwoods and 5.0 to 10.9 inches d.b.h. for hardwoods.

Saplings and seedling trees.— Well established live trees of commercial species less than 5.0 inches in diameter and of good form and vigor.

Sound cull trees.— Live trees of sawtimber or poletimber size that are unmerchantable for saw logs, now or prospectively, because of roughness, poor form, or species.

Rotten cull trees.— Live trees of sawtimber or poletimber size that are unmerchantable for saw logs,

now or prospectively, and with more than 50 percent of the defect due to rot.

Salvable dead trees.— Standing or down dead trees that are currently merchantable.

Diameter Measurements

Diameter at breast height.— The diameter of a tree at 4.5 feet above average ground level.

Diameter class.— Trees in a 2-inch diameter range, ranging from 1.0 inch below the midpoint of the class to 0.9 inch above the midpoint, e.g., the 6-inch class would include trees from 5.0 to 6.9 inches d.b.h.

Volume Classifications

Cord.— The amount of stacked wood contained in a pile whose dimensions indicate a gross volume of 128 cubic feet; equivalent to 79 cubic feet of solid wood.

Board foot.— A unit of measure for lumber one inch thick with one square foot of surface.

Growing stock volume.—Net volume in cords or cubic feet of all live, merchantable sawtimber and poletimber trees of all commercial species, from stump to a minimum 4.0-inch top diameter outside bark, on commercial forest land.

Sawtimber volume.— Net volume in board feet, International ¼-inch rule, of live merchantable sawtimber trees on commercial forest land. Minimum top diameter is 8.0 inches outside bark.

Log Grades

Sawtimber trees were graded with three standards, depending on species: (1) Hardwoods other than aspen were graded according to "Hardwood Log Grades for Standard Lumber," published by the U.S. Forest Products Laboratory in 1953; (2) aspen was graded according to "Aspen Lumber Grades and Characteristics," U.S. Lake States Forest Exp. Sta., Aspen Report No. 6, 1948; (3) softwoods were graded according to "Specifications for Log Grades of Hardwoods and Softwoods," Northern Hemlock and Hardwood Association, 1947.

Hardwood log grades include, in addition to the above, a grade 4 or tie and timber grade. A tie and timber log had to be sound internally, with no single knot or group of knots within any 6-inch section exceeding one-third the log diameter at that point. Rotten defects or holes could not extend more than 3 inches into a potential log or timber. Sweep could not exceed one-fourth the scaling diameter in any 8 feet of length.

Growth

Net annual growth.— The annual change in volume of sound wood in live sawtimber and poletimber trees on commercial forest land and the total volume of trees entering these classes through ingrowth, less natural losses.

Growing stock growth.— Net annual growth of poletimber and sawtimber trees in cords or cubic feet.

Sawtimber growth.— Net annual growth of sawtimber trees in board feet, International ¼-inch rule.

Timber Cut

Annual actual cut of growing stock.— The net cubic-foot volume of sawtimber and poletimber trees harvested and that killed by logging damage, land clearing, and cultural operations during a specified year.

Annual actual cut of sawtimber.— The net board-foot volume of live sawtimber trees harvested and that killed by logging, land clearing, and cultural operations on commercial forest land during a specified year.

Timber products output.— The volume of rough forest products cut from growing stock, cull and dead trees, limbwood, etc.

Logging residue.— The net cord volume of live sawtimber and poletimber trees cut or killed by logging on commercial forest land and not converted to timber products.

Desirable Cut

Annual desirable cut (formerly called allowable cut).— The net volume of live sawtimber and poletimber trees that can be commercially harvested annually during the next 10 years while maintaining or building a high level of growing stock and a reasonably even distribution of age classes below the rotation age selected for each type. It includes harvest cuts, improvement cuts yielding 3 cords or more per acre, and one-tenth of the entire net volume of stands 10 or more years beyond the rotation age. Stands past rotation age are subject to excessive mortality or deterioration and should be harvested first to reduce loss and improve timber growth.

Species Groups Recorded During The Survey

National groups	Local groups	*Species*
Softwoods:		
White and red pine	White pine	*Pinus strobus*
	Red pine	*Pinus resinosa*
Spruce and balsam fir	Black spruce	*Picea mariana*
	White spruce	*Picea glauca*
	Balsam fir	*Abies balsamea var. balsamea*
Other softwoods	Jack pine	*Pinus banksiana*
	Tamarack	*Larix laricina*
	Cedar	*Thuja occidentalis*
		Juniperus virginiana
Hardwoods:		
Select red and white oaks	Red oak	*Quercus rubra*
		Quercus palustris
	White oak	*Quercus alba*
		Quercus macrocarpa
Yellow birch	Yellow birch	*Betula alleghaniensis*
Hard maple	Hard maple	*Acer saccharum*
		Acer nigrum
Ash, walnut, black cherry	Ash	*Fraxinus nigra*
		Fraxinus americana
		Fraxinus pennsylvanica
	Walnut	*Juglans nigra*
	Black cherry	*Prunus serotina*
Other hardwoods	Aspen	*Populus tremuloides*
		Populus grandidentata
	Balsam poplar	*Populus balsamifera*
	Basswood	*Tilia americana*
	Cottonwood	*Populus deltoides*
	Elm	*Ulmus americana*
		Ulmus rubra
		Ulmus thomassii
	Paper birch	*Betula papyrifera var. papyrifera*
		Betula nigra
	Soft maple	*Acer rubrum var. rubrum*
		Acer saccharinum
Other hardwoods		*Robinia pseudoacacia*
		Acer negundo
		Juglans cinerea
		Carya sp.
		Celtis occidentalis
		Gleditsia triacanthos
		Ostrya virginiana
		Salix nigra

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Growth and Cut Projections

50. Timber growth and cut projections, Minnesota, 1962-1992.

Table 1.--Land area by classes and Forest Survey Units, Minnesota, 1962

(In acres)

Land class	All units	Lake Superior	Central Pine	Rainy River	South-eastern	Western
Forest land:						
Commercial forest	17,062,000	5,844,700	6,033,100	2,103,200	1,900,900	1,180,100
Unproductive forest	1,547,300	299,400	333,500	388,900	321,400	204,100
Productive-reserved forest	438,100	395,500	29,100	-	10,000	3,500
Total forest land	19,047,400	6,539,600	6,395,700	2,492,100	2,232,300	1,387,700
Nonforest land 1/	32,158,400	1,196,700	2,464,500	347,600	8,827,500	19,322,100
All land 2/	51,205,800	7,736,300	8,860,200	2,839,700	11,059,800	20,709,800

1/ Includes 668,000 acres of water according to Survey standards of area classification but defined by Bureau of the Census as land.

2/ From U. S. Bureau of the Census, Land and Water Area of the United States, 1950.

NOTE: Refinements in computing and additional data have made some of these statistics different from those reported in "Timber Trends in the U.S.", Forest Resource Report No. 17, published by the Forest Service, U.S. Dept. Agr., in 1965.

Table 2.--Area of commercial forest land, by ownership classes and Forest Survey Units, Minnesota, 1962

(In acres)

Ownership class	All units	Lake Superior	Central Pine	Rainy River	South-eastern	Western
National Forest	2,141,400	1,570,900	569,700	800	-	-
Other Federal:						
Bureau of Land Mangt.	64,000	400	5,300	55,000	-	3,300
Indian	521,800	70,000	296,000	121,200	-	34,600
Misc. Federal	92,100	-	33,800	-	44,000	14,300
Total other Federal	677,900	70,400	335,100	176,200	44,000	52,200
State	3,303,800	849,000	1,125,600	1,104,200	22,300	202,700
County and municipal	3,416,100	1,378,600	1,588,500	292,000	113,500	43,500
Forest industry:						
Pulp and paper	630,000	314,700	119,100	196,100	-	100
Lumber	47,400	11,600	31,700	900	2,500	700
Other	37,400	19,600	7,000	10,800	-	-
Total forest industry	714,800	345,900	157,800	207,800	2,500	800
Farmer-owned	3,344,300	510,000	869,400	86,800	1,201,100	677,000
Misc. private	3,463,700	1,119,900	1,387,000	235,400	517,500	203,900
All ownerships	17,062,000	5,844,700	6,033,100	2,103,200	1,900,900	1,180,100

NOTE: Refinements in computing and additional data have made some of these statistics different from those reported in "Timber Trends in the U.S.", Forest Resource Report No. 17, published by the Forest Service, U.S. Dept. Agr., in 1965.

Table 3.--Area of commercial forest land, by stand-size and ownership classes, Minnesota, 1962

(In acres)

MINNESOTA

Stand-size class	All ownerships	National Forest	Other public	Forest industry	Farmer and misc. private
Sawtimber	2,386,500	335,500	549,300	97,100	1,404,600
Poletimber	8,520,000	1,343,000	3,476,300	378,300	3,322,400
Sapling and seedling	4,294,500	304,000	2,246,200	205,800	1,538,500
Nonstocked	1,861,000	158,900	1,126,000	33,600	542,500
All classes	17,062,000	2,141,400	7,397,800	714,800	6,808,000

LAKE SUPERIOR UNIT

Sawtimber	627,600	243,900	194,200	47,800	141,700
Poletimber	3,097,800	959,200	1,042,100	188,500	908,000
Sapling and seedling	1,503,600	254,100	744,100	92,200	413,200
Nonstocked	615,700	113,700	317,600	17,400	167,000
All classes	5,844,700	1,570,900	2,298,000	345,900	1,629,900

CENTRAL PINE UNIT

Sawtimber	602,900	91,600	253,300	19,400	238,600
Poletimber	3,401,100	383,400	1,565,200	84,500	1,368,000
Sapling and seedling	1,360,300	49,500	771,000	45,200	494,600
Nonstocked	668,800	45,200	459,700	8,700	155,200
All classes	6,033,100	569,700	3,049,200	157,800	2,256,400

RAINY RIVER UNIT

Sawtimber	117,500	-	70,600	29,900	17,000
Poletimber	913,800	400	660,700	104,700	148,000
Sapling and seedling	761,900	400	563,800	65,800	131,900
Nonstocked	310,000	-	277,300	7,400	25,300
All classes	2,103,200	800	1,572,400	207,800	322,200

SOUTHEASTERN UNIT

Sawtimber	725,900	-	14,700	-	711,200
Poletimber	673,200	-	110,800	-	562,400
Sapling and seedling	352,300	-	54,300	2,500	295,500
Nonstocked	149,500	-	-	-	149,500
All classes	1,900,900	-	179,800	2,500	1,718,600

WESTERN UNIT

Sawtimber	312,600	-	16,500	-	296,100
Poletimber	434,100	-	97,500	600	336,000
Sapling and seedling	316,400	-	113,000	100	203,300
Nonstocked	117,000	-	71,400	100	45,500
All classes	1,180,100	-	298,400	800	880,900

NOTE: Refinements in computing and additional data have made some of these statistics different from those reported in "Timber Trends in the U.S.", Forest Resource Report No. 17, published by the Forest Service, U.S. Dept. Agr., in 1965.

Table 4.--Area of commercial forest land, by forest type and Forest Survey Units, Minnesota, 1962

(In acres)

Type	All units	Lake Superior	Central Pine	Rainy River	South-eastern	Western
White pine	134,500	79,400	40,000	8,600	6,300	200
Red pine	283,700	112,800	143,600	12,000	13,500	1,800
Jack pine	885,200	396,200	406,600	46,200	8,900	27,300
Balsam fir	1,173,800	711,700	269,900	181,300	5,700	5,200
White spruce	74,100	52,400	5,200	13,500	2,900	100
Black spruce	1,407,700	625,300	259,300	502,900	4,800	15,400
Tamarack	567,500	84,600	265,600	140,700	55,500	21,100
Cedar	417,300	129,200	117,000	161,700	-	9,400
Northern hdwds.	1,009,100	217,600	397,700	9,200	267,200	117,400
Oak	1,039,500	23,500	354,100	2,300	580,500	79,100
Lowland hdwds.	1,496,600	243,300	513,400	107,800	354,400	277,700
Balsam poplar	452,900	124,800	156,100	131,000	-	41,000
Aspen	5,451,000	1,950,400	2,159,800	430,300	446,700	463,800
Paper birch	803,100	477,800	276,000	45,700	-	3,600
Cottonwood	5,000	-	-	-	5,000	-
Grass and upland brush	450,500	174,700	156,000	42,400	41,600	35,800
Lowland brush	1,410,500	441,000	512,800	267,600	107,900	81,200
All types	17,062,000	5,844,700	6,033,100	2,103,200	1,900,900	1,180,100

NOTE: Refinements in computing and additional data have made some of these statistics different from those reported in "Timber Trends in the U.S.", Forest Resource Report No. 17, published by the Forest Service, U.S. Dept. Agr., in 1965.

Table 5.--Area of commercial forest land, by sawtimber volume and stand-size classes, Minnesota, 1962

(In acres)

Volume per acre (board feet)1/	All stands	Sawtimber stands	Other stands
Less than 1,500	14,675,000	792,900	13,882,100
1,500 to 5,000	1,557,000	889,400	667,600
More than 5,000	830,000	704,200	125,800
Total	17,062,000	2,386,500	14,675,500

1/ Net volume, International 1/4-inch rule.

NOTE: Refinements in computing and additional data have made some of these statistics different from those reported in "Timber Trends in the U.S.", Forest Resource Report No. 17, published by the Forest Service, U.S. Dept. Agr., in 1965.

Table 6.--Area of commercial forest land, by stocking classes based on alternative stand components, Minnesota, 1962

(In acres)

Stocking class (percent)	Stocking classified in terms of: All trees	Growing stock trees	Desirable trees
90-100	5,772,200	3,048,700	1,219,500
80-90	3,561,300	2,854,000	1,942,600
70-80	837,800	585,400	237,300
60-70	2,105,900	3,043,700	2,665,600
50-60	981,400	1,192,100	645,600
40-50	1,063,700	1,508,700	2,539,600
30-40	512,700	1,178,400	1,188,100
20-30	468,900	1,048,700	1,948,200
10-20	391,100	741,300	1,123,600
Less than 10	1,367,000	1,861,000	3,551,900
Total	17,062,000	17,062,000	17,062,000

Table 7.--Area of commercial forest land, by stocking classes of growing stock trees and by stand-size classes, Minnesota, 1962

(In acres)

Stocking class (percent)	All stands	Sawtimber stands	Poletimber stands	Sapling and seedling stands	Nonstocked stands
70 or more	6,488,100	829,800	3,641,300	2,017,000	-
40-70	5,744,500	988,900	3,389,400	1,366,200	-
10-40	2,968,400	567,800	1,489,300	911,300	-
Less than 10	1,861,000	-	-	-	1,861,000
All classes	17,062,000	2,386,500	8,520,000	4,294,500	1,861,000

NOTE: Refinements in computing and additional data have made some of these statistics different from those reported in "Timber Trends in the U.S.", Forest Resource Report No. 17, published by the Forest Service, U.S. Dept. Agr., in 1965.

Table 8.--Area of commercial forest land, by area-condition and ownership classes, Minnesota, 1962

(In acres)

Area condition class	All ownerships	National Forest	Other public	Forest industry	Farmer and misc. private
Desirable	4,071,700	501,500	2,194,500	315,200	1,060,500
Moderate and favorable	3,574,900	540,200	1,565,500	167,100	1,302,100
Moderate and unfavorable	2,190,300	473,600	942,800	76,600	697,300
Poor but favorable	2,137,400	253,200	471,300	41,700	1,371,200
Poor and unfavorable	5,087,700	372,900	2,223,700	114,200	2,376,900
All classes	17,062,000	2,141,400	7,397,800	714,800	6,808,000

NOTE: Refinements in computing and additional data have made some of these statistics different from those reported in "Timber Trends in the U.S.", Forest Resource Report No. 17, published by the Forest Service, U.S. Dept. Agr., in 1965.

Table 9.--Area of commercial forest land, by sites and ownership classes, Minnesota, 1962

(In acres)

Site class (growth per acre per year in cu. ft.)	All ownerships	National Forest	Other public	Forest industry	Farmer and misc.private
120 or more	4,300	-	2,700	500	1,100
85-120	916,300	100,900	339,000	34,200	442,200
50-85	7,755,400	1,050,000	3,061,500	333,200	3,310,700
Less than 50	8,386,000	990,500	3,994,600	346,900	3,054,000
All classes	17,062,000	2,141,400	7,397,800	714,800	6,808,000

NOTE: Refinements in computing and additional data have made some of these statistics different from those reported in "Timber Trends in the U.S.", Forest Resource Report No. 17, published by the Forest Service, U.S. Dept. Agr., in 1965.

Table 10.--Area of commercial forest land, by forest types and ownership classes, Minnesota, 1962

(In acres)

Forest type	All ownerships	Public ownerships	Private ownerships
White-red-jack pine	1,355,000	878,000	477,000
Spruce-fir	4,561,000	3,356,000	1,205,000
Oak-hickory	1,080,000	206,000	874,000
Elm-ash-cottonwood	2,045,000	855,000	1,190,000
Maple-beech	1,049,000	403,000	646,000
Aspen-birch	6,972,000	3,841,000	3,131,000
All types	17,062,000	9,539,000	7,523,000

NOTE: Refinements in computing and additional data have made some of these statistics different from those reported in "Timber Trends in the U.S.", Forest Resource Report No. 17, published by the Forest Service, U.S. Dept. Agr., in 1965.

Table 11.--Area of commercial forest land, by forest types and site classes, Minnesota, 1962

(In acres)

Forest type	All sites	Site class 1/			
		Excellent	Good	Medium	Poor
White pine	134,500	-	10,100	33,000	91,400
Red pine	283,700	15,800	92,500	151,300	24,100
Jack pine	885,200	14,000	158,300	560,400	152,500
Balsam fir	1,173,800	124,200	355,900	448,200	245,500
White spruce	74,100	4,200	12,000	37,300	20,600
Black spruce	1,407,700	170,000	372,100	422,000	443,600
Tamarack	567,500	23,300	84,000	182,200	278,000
Cedar	417,300	15,900	61,100	192,300	148,000
Northern hdwds.	1,009,100	52,200	167,000	416,300	373,600
Oak	1,039,500	65,100	151,700	372,500	450,200
Lowland hdwds.	1,496,600	105,400	231,500	429,100	730,600
Balsam poplar	452,900	10,600	85,000	178,200	179,100
Aspen	5,451,000	650,100	1,591,000	1,873,500	1,336,400
Paper birch	803,100	89,900	273,800	288,300	151,100
Cottonwood	5,000	-	-	5,000	-
Grass and upland brush	450,500	2,100	63,300	189,000	196,100
Lowland brush	1,410,500	7,100	203,300	414,800	785,300
All types	17,062,000	1,349,900	3,912,600	6,193,400	5,606,100

1/ See Appendix for the range of site index for each site class in each type.

Table 12.--Area of commercial forest land, by forest types and stand-age classes, Minnesota, 1962

(In acres)

Forest type	All ages	Age class (years)									
		Less than 9	10-19	20-29	30-39	40-49	50-59	60-79	80-99	100-119	120+
White pine	134,500	2,700	4,200	3,000	4,700	3,500	11,400	50,700	26,500	5,000	22,800
Red pine	283,700	21,900	21,200	33,400	10,000	26,900	55,700	68,000	28,800	6,300	11,500
Jack pine	885,200	38,900	83,600	82,600	145,600	181,400	117,800	178,500	50,000	3,800	3,000
Balsam fir	1,173,800	75,000	82,800	147,500	210,900	274,700	203,100	169,200	10,300	300	-
White spruce	74,100	3,200	1,800	2,400	2,100	2,500	10,300	24,000	13,600	12,300	1,900
Black spruce	1,407,700	70,900	68,600	97,700	122,000	153,800	143,200	323,900	250,300	92,300	85,000
Tamarack	567,500	40,400	33,700	67,800	66,100	57,400	60,000	101,300	56,800	43,500	40,500
Cedar	417,300	19,900	16,500	11,400	13,400	22,600	47,700	84,100	78,000	57,100	66,600
Northern hdwds.	1,009,100	33,700	49,300	76,100	140,400	146,000	135,000	210,300	95,200	61,100	62,000
Oak	1,039,500	16,600	33,700	148,100	177,300	162,100	153,400	208,300	111,600	20,600	7,800
Lowland hdwds.	1,496,600	27,500	91,700	127,200	127,900	256,800	184,300	313,800	206,200	85,300	75,900
Balsam poplar	452,900	24,700	68,100	63,700	134,300	93,800	36,100	27,100	2,400	2,700	-
Aspen	5,451,000	320,600	559,000	1,004,900	1,642,400	1,202,000	409,300	260,300	51,600	900	-
Paper birch	803,100	30,300	28,600	86,400	215,900	214,500	89,500	100,100	26,800	6,200	4,800
Cottonwood	5,000	-	5,000	-	-	-	-	-	-	-	-
Grass and upland brush	450,500	426,200	-	-	5,000	5,000	5,800	5,000	3,500	-	-
Lowland brush	1,410,500	1,335,700	11,900	33,400	8,700	4,300	9,300	-	3,600	-	3,600
All types	17,062,000	2,488,200	1,159,700	1,985,600	3,026,700	2,807,300	1,671,900	2,124,600	1,015,200	397,400	385,400

Table 13.--Area of noncommercial forest land, by forest types, Minnesota, 1962

(In acres)

Forest type	All areas	Productive-reserved areas	Unproductive areas
White-red-jack pine	150,300	150,300	-
Spruce-fir	1,117,200	101,400	1,015,800
Oak-hickory	225,500	4,600	220,900
Elm-ash-cottonwood	94,700	6,900	87,800
Maple-beech	12,660	3,800	8,800
Aspen-birch	385,100	171,100	214,000
All types	1,985,400	438,100	1,547,300

Table 14.--Area of commercial forest land, by forest types, Minnesota, in 1936, 1953, and 1962

(In acres)

Forest type	1936	1953	1962
White pine	224,000	125,000	134,000
Red pine	167,000	166,000	284,000
Jack pine	1,219,000	986,000	885,000
Spruce-fir	1,053,000	1,233,000	1,248,000
Black spruce	1,475,000	1,169,000	1,408,000
Tamarack	655,000	482,000	568,000
Cedar	378,000	284,000	417,000
Northern hardwoods	886,000	846,000	1,009,000
Oak	988,000	1,182,000	1,039,000
Lowland hardwoods	607,000	1,145,000	1,502,000
Aspen-birch	6,680,000	5,997,000	6,707,000
Nonstocked	3,768,000	3,713,000	1,861,000
All types	18,100,000	17,328,000	17,062,000

Table 15.--Area of commercial forest land, by stand-size classes, Minnesota, in 1936, 1953, and 1962

(In acres)

Stand-size class	1936	1953	1962
Sawtimber	1,520,000	2,017,000	2,387,000
Poletimber	4,417,000	5,281,000	8,520,000
Sapling and seedling			
Medium to well-stocked	4,106,000	4,646,000	3,383,000
Poorly stocked	4,289,000	1,671,000	911,000
Nonstocked	3,768,000	3,713,000	1,861,000
All classes	18,100,000	17,328,000	17,062,000

NOTE: Refinements in computing and additional data have made some of these statistics different from those reported in "Timber Trends in the U.S.", Forest Resource Report No. 17, published by the Forest Service, U.S. Dept. Agr., in 1965.

Table 16.--Area of commercial forest land, by forest types and area-condition classes,[1/] Minnesota, 1962

(In acres)

Forest type	All area conditions	Desirable	Moderate and favorable	Moderate and unfavorable	Poor but favorable	Poor and unfavorable
White pine	134,500	45,800	36,100	21,800	9,600	21,200
Red pine	283,700	122,000	78,500	39,800	13,700	29,700
Jack pine	885,200	348,200	258,800	90,600	74,400	113,200
Balsam fir	1,173,800	398,800	329,100	173,700	90,000	182,200
White spruce	74,100	20,200	21,200	13,100	10,300	9,300
Black spruce	1,407,700	685,600	321,000	158,400	106,500	136,200
Tamarack	567,500	188,200	109,200	110,100	45,400	114,600
Cedar	417,300	153,400	110,900	63,900	37,400	51,700
Northern hdwds.	1,009,100	135,000	266,300	122,400	272,200	213,200
Oak	1,039,500	125,700	166,000	92,100	341,000	314,700
Lowland hdwds.	1,496,600	194,600	337,500	188,700	320,100	455,700
Balsam poplar	452,900	112,500	84,600	98,000	39,300	118,500
Aspen	5,451,000	1,310,300	1,225,600	897,500	690,500	1,327,100
Paper birch	803,100	231,400	230,100	120,200	42,300	179,100
Cottonwood	5,000	-	-	-	-	5,000
Grass and upland brush	450,500	-	-	-	23,000	427,500
Lowland brush	1,410,500	-	-	-	21,700	1,388,800
All types	17,062,000	4,071,700	3,574,900	2,190,300	2,137,400	5,087,700

1/ Area condition classification:
Desirable.--70 percent or more stocked with desirable trees.
Moderate and favorable.--40-to 70-percent stocked with desirable trees and less than 30 percent of the area controlled by inhibiting vegetation or surface conditions that will prevent occupancy by desirable trees.
Moderate and unfavorable.--40-to 70-percent stocked with desirable trees, more than 30 percent of the area controlled by inhibiting vegetation or surface conditions that will prevent occupancy by desirable trees.
Poor but favorable.--Less than 40-percent stocked with desirable trees and with adequate seed source and seedbed favorable to natural regeneration.
Poor and unfavorable.--Areas less than 40-percent stocked with desirable trees, inadequate seed source or seedbed unfavorable to natural regeneration.

NOTE: Refinements in computing and additional data have made some of these statistics different from those reported in "Timber Trends in the U.S.", Forest Resource Report No. 17, published by the Forest Service, U.S. Dept. Agr., in 1965.

Table 17.--Area of land and forest land, by counties, Minnesota, 1962

LAKE SUPERIOR UNIT

County	All land	Forest land			Commercial forest as a percent of land area
		All forest	Non-commercial	Commercial	
	Acres	Acres	Acres	Acres	Percent
Carlton	550,400	383,400	16,400	367,000	67
Cook	897,900	868,900	158,900	710,000	79
Lake	1,364,500	1,306,800	202,800	1,104,000	81
Pine	903,700	515,900	56,500	459,400	51
St. Louis	4,019,800	3,464,600	260,300	3,204,300	80
Total	7,736,300	6,539,600	694,900	5,844,700	76

CENTRAL PINE UNIT

Aitkin	1,167,400	900,400	49,800	850,600	73
Becker	841,600	390,100	4,200	385,900	46
Beltrami	1,610,900	1,178,200	185,200	993,000	62
Cass	1,313,900	1,023,800	17,400	1,006,400	77
Clearwater	643,200	394,500	26,800	367,700	57
Crow Wing	639,400	449,500	2,000	447,500	70
Hubbard	596,500	445,800	5,700	440,100	74
Itasca	1,704,300	1,480,900	69,000	1,411,900	83
Wadena	343,000	132,500	2,500	130,000	38
Total	8,860,200	6,395,700	362,600	6,033,100	68

RAINY RIVER UNIT

Koochiching	2,002,600	1,868,700	294,000	1,574,700	79
Lake of the Woods	837,100	623,400	94,900	528,500	63
Total	2,839,700	2,492,100	388,900	2,103,200	74

SOUTHEASTERN UNIT

Anoka	272,000	74,400	12,300	62,100	23
Benton	258,600	35,000	7,700	27,300	11
Carver	229,100	28,400	4,500	23,900	10
Chisago	268,200	66,100	13,200	52,900	20
Dakota	365,400	42,100	8,500	33,600	9
Douglas	407,700	48,200	5,900	42,300	10
Fillmore	549,800	90,100	6,400	83,700	15
Goodhue	485,100	71,100	8,100	63,000	13
Hennepin	361,600	36,800	6,200	30,600	8
Houston	361,600	127,800	13,000	114,800	32
Isanti	282,900	60,900	9,700	51,200	18
Kanabec	336,000	177,400	22,800	154,600	46
Le Sueur	282,200	31,200	1,700	29,500	10
Mille Lacs	363,500	157,500	26,200	131,300	36
Morrison	727,000	230,300	30,000	200,300	28

(Continued)

Table 17 (Cont'd)

SOUTHEASTERN UNIT

County	All land	Forest land			Commercial forest as a percent of land area
		All forest	Non-commercial	Commercial	
	Acres	Acres	Acres	Acres	Percent
Olmstead	419,200	52,900	5,000	47,900	11
Otter Tail	1,280,000	268,200	35,900	232,300	18
Ramsey	102,400	8,700	2,100	6,600	6
Rice	316,800	25,700	2,700	23,000	7
Scott	225,300	27,000	3,400	23,600	10
Sherburne	280,300	59,100	16,800	42,300	15
Stearns	867,800	103,100	24,900	78,200	9
Todd	606,100	147,600	19,300	128,300	21
Wabasha	333,400	65,300	13,700	51,600	16
Washington	249,600	33,300	6,400	26,900	11
Winona	398,700	114,700	18,200	96,500	24
Wright	429,500	49,400	6,800	42,600	10
Total	11,059,800	2,232,300	331,400	1,900,900	17

WESTERN UNIT

Big Stone	326,400	4,000	200	3,800	1
Blue Earth	473,600	33,300	1,900	31,400	7
Brown	392,300	15,800	1,100	14,700	4
Chippewa	372,500	8,500	700	7,800	2
Clay	672,000	24,900	4,900	20,000	3
Cottonwood	409,600	7,100	400	6,700	2
Dodge	278,400	9,000	500	8,500	3
Faribault	456,300	13,600	800	12,800	3
Freeborn	449,300	16,400	1,000	15,400	3
Grant	356,500	5,400	300	5,100	1
Jackson	446,700	6,800	600	6,200	1
Kandiyohi	527,400	23,200	2,000	21,200	4
Kittson	719,400	119,700	25,500	94,200	13
Lac qui Parle	494,700	8,600	500	8,100	2
Lincoln	345,600	5,400	300	5,100	2
Lyons	456,300	6,700	800	5,900	1
Mahnomen	367,400	128,800	2,200	126,600	34
Marshall	1,152,000	203,200	51,600	151,600	13
Martin	452,500	7,200	400	6,800	2
McLeod	318,700	11,000	600	10,400	3
Meeker	396,800	16,600	900	15,700	4
Mower	449,900	9,900	500	9,400	2
Murray	453,100	5,100	500	4,600	1
Nicollet	293,800	18,200	1,100	17,100	6
Nobles	455,700	3,300	200	3,100	1
Norman	566,400	33,300	3,300	30,000	5
Pennington	398,100	44,000	8,400	35,600	9
Pipestone	297,000	1,900	100	1,800	1
Polk	1,287,700	91,800	17,300	74,500	6
Pope	435,800	18,200	1,000	17,200	4

(Continued)

Table 17 (Cont'd)

WESTERN UNIT

County	All land	Forest land			Commercial forest as a percent of land area
		All forest	Non-commercial	Commercial	
	Acres	Acres	Acres	Acres	Percent
Red Lake	276,500	43,100	6,200	36,900	13
Redwood	559,300	10,900	600	10,300	2
Renville	627,200	15,000	800	14,200	2
Rock	310,400	2,000	100	1,900	1
Roseau	1,072,600	336,600	65,600	271,000	25
Sibley	371,800	24,900	1,400	23,500	6
Steele	272,000	10,500	800	9,700	4
Stevens	364,800	2,500	100	2,400	1
Swift	478,100	8,400	600	7,800	2
Traverse	366,100	2,600	100	2,500	1
Waseca	265,600	12,300	700	11,600	4
Watonwan	277,100	5,400	300	5,100	2
Wilkin	481,300	2,100	100	2,000	-
Yellow Medicine	485,100	10,500	600	9,900	2
Total	20,709,800	1,387,700	207,600	1,180,100	6

ALL UNITS

All counties	51,205,800	19,047,400	1,985,400	17,062,000	33

Table 18.--Number of growing stock trees on commercial forest land, by species and diameter classes, Minnesota, 1962

(In thousand trees)

Species	All diameters	Diameter class (inches at breast height) 3.0- 4.9	5.0- 6.9	7.0- 8.9	9.0- 10.9	11.0- 12.9	13.0- 14.9	15.0- 16.9	17.0- 18.9	19.0- 28.9	29.0- 38.9	39.0 & larger
Softwoods:												
White pine	28,567	5,113	6,897	5,986	3,828	2,655	1,366	1,172	849	664	37	-
Red pine	63,149	17,098	15,036	9,952	8,885	5,697	3,832	1,628	817	299	2	3
Jack pine	336,368	108,397	114,197	64,709	33,937	11,195	3,055	788	81	9	-	-
Balsam fir	679,157	426,933	178,451	55,629	13,452	3,655	741	245	50	1	-	-
White spruce	46,081	18,088	13,433	6,035	3,467	2,462	932	1,021	448	195	-	-
Black spruce	830,776	530,163	228,728	60,108	9,756	1,477	369	145	17	13	-	-
Tamarack	239,152	99,363	107,774	25,647	5,092	883	278	101	14	-	-	-
Cedar	216,924	115,232	63,259	25,365	8,261	3,381	904	342	136	44	-	-
Total softwoods	2,440,174	1,320,387	727,775	253,431	86,578	31,405	11,477	5,442	2,412	1,225	39	3
Hardwoods:												
Hard maple	80,187	45,562	17,296	6,762	3,910	3,809	1,528	995	150	174	1	-
Yellow birch	3,313	249	1,091	198	211	330	403	388	295	148	-	-
Basswood	130,921	60,715	36,604	15,120	8,321	5,644	2,691	1,742	621	463	-	-
Balsam poplar	144,552	58,688	50,164	19,665	9,781	4,213	1,555	269	160	56	1	-
Elm	136,986	71,779	25,306	15,846	9,829	5,781	4,033	1,820	1,113	1,457	20	2
Red oak	134,564	47,700	41,783	22,579	11,663	5,467	2,636	1,365	838	515	18	-
White oak	98,700	46,146	23,466	13,128	8,361	3,268	2,281	760	602	678	10	-
Aspen	1,456,588	613,918	514,431	211,752	79,802	25,612	8,049	2,494	376	154	-	-
Cottonwood	1,820	1,022	14	201	369	-	100	-	54	60	-	-
Paper birch	662,864	398,366	187,981	51,825	16,608	5,509	1,317	957	182	119	-	-
Soft maple	77,261	54,308	13,059	4,739	2,756	801	885	349	246	118	-	-
Ash	248,022	139,245	63,358	25,533	11,040	5,771	1,631	574	606	264	-	-
Other hardwoods	68,815	46,565	15,234	4,279	1,371	902	283	90	69	22	-	-
Total hardwoods	3,244,593	1,584,263	988,787	391,627	164,022	67,107	27,392	11,803	5,312	4,228	50	2
All species	5,684,767	2,904,650	1,716,562	645,058	250,600	98,512	38,869	17,245	7,724	5,453	89	5

Table 19.---Number of cull and salvable dead trees on commercial forest land, by species and diameter classes, Minnesota, 1962

(In thousand trees)

Diameter class (inches)	Cull trees	Salvable dead trees
Softwoods:		
5.0 - 8.9	9,265	1,814
9.0 - 18.9	2,037	233
19.0 and larger	-	*
Total	11,302	2,047
Hardwoods:		
5.0 - 10.9	92,731	846
11.0 - 18.9	23,631	35
19.0 and larger	3,029	1
Total	119,391	882
All species	130,693	2,929

* Less than 500 trees.

Table 20.--Volume of timber on commercial forest land, by tree and species classes, Minnesota, 1962

(In thousand cubic feet)

Tree class	All species	Softwoods	Hardwoods
Growing stock:			
Sawtimber			
Saw log portion	2,412,036	1,050,016	1,362,020
Upper stem portion	409,006	261,732	147,274
Total sawtimber	2,821,042	1,311,748	1,509,294
Poletimber	6,980,764	2,295,518	4,685,246
Total growing stock	9,801,806	3,607,266	6,194,540
Sound cull:			
Sawtimber	110,000	18,000	92,000
Poletimber	78,000	8,000	70,000
Total sound cull	188,000	26,000	162,000
Rotten cull:			
Sawtimber	173,000	25,000	148,000
Poletimber	163,000	26,000	137,000
Total rotten cull	336,000	51,000	285,000
Salvable dead:			
Sawtimber	1,063	955	108
Poletimber	9,975	7,437	2,538
Total salvable dead	11,038	8,392	2,646
All classes[1/]	10,336,844	3,692,658	6,644,186

1/ Estimates of additional volumes on unproductive forest land total 12,224 thousand cubic feet in trees 5.0 inches and larger d.b.h., including 8,019 thousand cubic feet of softwoods and 4,205 thousand cubic feet of hardwoods.

NOTE: Refinements in computing and additional data have made some of these statistics different from those reported in "Timber Trends in the U.S.", Forest Resource Report No. 17, published by the Forest Service, U.S. Dept. Agr., in 1965.

Table 21.--Volume of growing stock and sawtimber on commercial forest land, by ownership and species classes, Minnesota, 1962

GROWING STOCK
(In thousand cubic feet)

Ownership class	All species	Softwoods	Hardwoods
National Forest	1,713,423	905,411	808,012
Other public	4,106,633	1,723,732	2,382,901
Forest industry	579,070	283,800	295,270
Farmer and misc. private	3,402,680	694,323	2,708,357
All ownerships	9,801,806	3,607,266	6,194,540

SAWTIMBER
(In thousand board feet)[1/]

National Forest	1,840,990	1,233,300	607,690
Other public	6,099,700	3,266,210	2,833,490
Forest industry	916,310	531,310	385,000
Farmer and misc. private	6,661,270	1,528,710	5,132,560
All ownerships	15,518,270	6,559,530	8,958,740

1/ International 1/4-inch rule.

Table 22.--Volume of growing stock and sawtimber on commercial forest land, by stand-size and species classes, Minnesota, 1962

GROWING STOCK
(In thousand cubic feet)

Stand-size class	All species	Softwoods	Hardwoods
Sawtimber	2,256,990	837,558	1,419,432
Poletimber	6,893,777	2,424,573	4,469,204
Sapling and seedling	626,438	335,062	291,376
Nonstocked	24,601	10,073	14,528
All classes	9,801,806	3,607,266	6,194,540

SAWTIMBER
(In thousand board feet)[1/]

Sawtimber	9,068,760	3,504,960	5,563,800
Poletimber	5,865,740	2,756,890	3,108,850
Sapling and seedling	550,440	285,150	265,290
Nonstocked	33,330	12,530	20,800
All classes	15,518,270	6,559,530	8,958,740

1/ International 1/4-inch rule.

Table 23.--Volume of growing stock on commercial forest land, by species and diameter class, Minnesota, 1962

(In thousand cubic feet)

Species	Diameter class (inches at breast height)										
	All diameters	5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-28.9	29.0-38.9	39.0 & larger
Softwoods:											
White pine	203,875	12,648	23,163	22,957	30,596	20,927	26,157	23,100	36,838	7,489	-
Red pine	345,483	28,124	47,905	57,117	71,526	61,470	33,970	23,874	20,864	356	277
Jack pine	815,564	210,669	259,254	181,447	105,662	38,837	16,780	2,512	403	-	-
Balsam fir	715,772	322,209	239,117	91,506	42,076	12,119	8,406	300	39	-	-
White spruce	181,178	22,910	24,119	38,275	30,921	18,027	27,002	12,087	7,837	-	-
Black spruce	763,709	407,379	268,829	60,309	16,590	6,059	3,208	672	663	-	-
Tamarack	318,631	154,943	109,763	35,392	7,355	7,892	2,994	292	-	-	-
Cedar	263,054	90,392	74,094	47,242	28,630	11,755	6,027	3,405	1,509	-	-
Total softwoods	3,607,266	1,249,274	1,046,244	534,245	333,356	177,086	124,544	66,242	68,153	7,845	277
Hardwoods:											
Hard maple	137,855	21,425	21,014	20,501	31,687	18,620	14,315	3,752	6,138	403	-
Yellow birch	17,341	1,454	916	1,098	1,770	3,697	3,231	2,086	3,057	32	-
Basswood	347,197	56,272	57,852	59,376	62,292	45,717	34,728	16,250	14,710	-	-
Balsam poplar	371,924	113,523	98,781	76,235	40,914	26,331	7,695	6,036	2,180	229	-
Elm	384,114	39,074	59,938	56,777	55,948	56,208	33,022	27,105	53,823	1,477	742
Red oak	373,583	73,707	86,363	72,798	50,615	33,694	21,812	18,328	15,705	561	-
White oak	204,871	37,186	41,309	39,176	25,027	23,526	13,469	10,847	13,730	601	-
Aspen	3,018,171	1,003,774	976,677	605,085	245,666	120,420	43,734	14,141	8,643	31	-
Cottonwood	6,834	-	996	1,003	-	1,114	-	1,612	2,109	-	-
Paper birch	768,488	344,582	211,870	118,729	51,018	17,807	16,219	5,593	2,670	-	-
Soft maple	96,522	19,362	17,862	16,764	9,504	14,836	5,917	6,786	5,491	-	-
Ash	418,131	117,180	103,040	80,067	58,689	23,510	13,580	12,063	10,002	-	-
Other hardwoods	49,509	17,996	8,034	7,450	8,848	2,639	2,188	1,161	1,193	-	-
Total hardwoods	6,194,540	1,845,535	1,684,652	1,155,059	641,978	388,119	209,910	125,760	139,451	3,334	742
All species	9,801,806	3,094,809	2,730,896	1,689,304	975,334	565,205	334,454	192,002	207,604	11,179	1,019

Table 24.--Volume of sawtimber on commercial forest land, by species and diameter classes, Minnesota, 1962

(In thousand board feet)[1/]

Species	Diameter class (inches at breast height)								
	All diameters	9.0-10.9 [2/]	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-28.9	29.0-38.9	39.0 & larger
Softwoods:									
White pine	956,750	113,690	149,070	127,820	158,910	135,530	233,550	38,180	-
Red pine	1,625,190	328,850	403,630	402,580	217,850	159,290	109,540	2,240	1,210
Jack pine	1,560,200	744,110	499,710	196,770	107,060	10,760	1,790	-	-
Balsam fir	740,260	447,160	205,100	54,610	29,820	3,540	30	-	-
White spruce	651,730	167,740	132,850	82,520	134,630	80,850	53,140	-	-
Black spruce	335,380	230,330	56,880	26,130	16,380	3,000	2,660	-	-
Tamarack	296,450	215,240	48,910	23,610	7,190	1,500	-	-	-
Cedar	393,570	195,680	110,720	46,000	21,590	14,200	5,380	-	-
Total sftwds.	6,559,530	2,442,800	1,606,870	960,040	693,430	408,670	406,090	40,420	1,210
Hardwoods:									
Hard maple	465,630	-	180,990	119,130	98,260	24,290	40,970	1,990	-
Yellow birch	79,620	-	9,500	20,080	20,660	10,370	18,910	100	-
Basswood	1,040,140	-	354,380	276,530	219,290	93,650	96,290	-	-
Balsam poplar	530,860	-	268,240	172,850	43,830	31,840	13,220	880	-
Elm	1,413,890	-	324,400	347,120	209,540	174,980	340,750	11,640	5,460
Red oak	885,400	-	298,570	210,390	155,190	120,180	96,130	4,940	-
White oak	600,710	-	151,130	142,630	77,400	69,430	156,940	3,180	-
Aspen	2,387,860	-	1,314,800	680,620	272,620	69,620	50,200	-	-
Cottonwood	39,110	-	-	10,550	-	13,570	14,990	-	-
Paper birch	448,280	-	240,640	90,910	74,080	28,650	14,000	-	-
Soft maple	238,050	-	49,660	77,940	37,060	37,680	35,710	-	-
Ash	743,830	-	365,700	143,560	70,230	98,530	65,810	-	-
Other hardwoods	85,360	-	43,300	16,340	14,690	5,350	5,680	-	-
Total hdwds.	8,958,740	-	3,601,310	2,308,650	1,292,850	778,140	949,600	22,730	5,460
All species	15,518,270	2,442,800	5,208,180	3,268,690	1,986,280	1,186,810	1,355,690	63,150	6,670

1/ International 1/4-inch rule.
2/ Softwood only.

Table 25.--Volume of growing stock on commercial forest land, by species and Forest Survey Unit, Minnesota, 1962

(In thousand cubic feet)

Species	All units	Lake Superior	Central Pine	Rainy River	South-eastern	Western
Softwoods:						
White pine	203,875	99,777	78,297	23,037	2,559	205
Red pine	345,483	122,656	195,296	17,230	1,580	8,721
Jack pine	815,564	463,643	295,215	35,384	8,603	12,719
Balsam fir	715,772	357,467	199,040	147,936	-	11,329
White spruce	181,178	113,791	32,343	33,701	893	450
Black spruce	763,709	318,054	114,779	321,925	284	8,667
Tamarack	318,631	74,758	134,316	81,859	19,632	8,066
Cedar	263,054	94,097	63,539	99,580	-	5,838
Total softwoods	3,607,266	1,644,243	1,112,825	760,652	33,551	55,995
Hardwoods:						
Hard maple	137,855	26,536	82,445	1,138	22,096	5,640
Yellow birch	17,341	11,755	5,443	-	143	-
Basswood	347,197	30,233	155,922	20,422	88,820	51,800
Balsam poplar	371,924	117,212	119,480	92,628	3,950	38,654
Elm	384,114	31,711	138,471	35,202	91,948	86,782
Red oak	373,583	12,126	176,352	158	166,445	18,502
White oak	204,871	3,587	79,521	3,950	81,252	36,561
Aspen	3,018,171	1,125,545	1,318,399	335,355	113,080	125,792
Cottonwood	6,834	-	-	-	4,353	2,481
Paper birch	768,488	398,468	280,142	52,179	28,551	9,148
Soft maple	96,522	23,684	34,318	1,288	19,449	17,783
Ash	418,131	112,370	153,126	43,315	61,059	48,261
Other hardwoods	49,509	1,272	5,672	205	35,076	7,284
Total hardwoods	6,194,540	1,894,499	2,549,291	585,840	716,222	448,688
All species	9,801,806	3,538,742	3,662,116	1,346,492	749,773	504,683

Table 26.--Volume of sawtimber on commercial forest land, by species and Forest Survey Units, Minnesota, 1962

(In thousand board feet)[1/]

Species	All units	Lake Superior	Central Pine	Rainy River	South-eastern	Western
Softwoods:						
White pine	956,750	379,180	454,140	106,330	15,620	1,480
Red pine	1,625,190	455,360	1,034,440	72,760	-	62,630
Jack pine	1,560,200	787,430	655,740	39,260	38,700	39,070
Balsam fir	740,260	284,060	295,780	147,290	-	13,130
White spruce	651,730	333,510	187,980	122,360	4,860	3,020
Black spruce	335,380	186,850	26,700	119,260	-	2,570
Tamarack	296,450	30,300	125,550	111,660	14,510	14,430
Cedar	393,570	130,770	98,110	161,880	-	2,810
Total sftwds.	6,559,530	2,587,460	2,878,440	880,800	73,690	139,140
Hardwoods:						
Hard maple	465,630	54,780	277,350	1,220	99,120	33,160
Yellow birch	79,620	57,130	21,140	-	1,350	-
Basswood	1,040,140	92,120	365,470	64,650	319,260	198,640
Balsam poplar	530,860	178,260	199,510	105,710	13,110	34,270
Elm	1,413,890	157,440	396,590	96,520	430,010	333,330
Red oak	885,400	20,270	252,410	-	572,540	40,180
White oak	600,710	5,200	202,850	5,440	266,890	120,330
Aspen	2,387,860	884,240	1,021,780	288,750	104,310	88,780
Cottonwood	39,110	-	-	-	28,980	10,130
Paper birch	448,280	189,130	174,840	62,520	16,040	5,750
Soft maple	238,050	6,930	60,830	1,300	86,230	82,760
Ash	743,830	185,150	184,460	39,530	110,970	223,720
Other hdwds.	85,360	-	-	-	67,770	17,590
Total hdwds.	8,958,740	1,830,650	3,157,230	665,640	2,116,580	1,188,640
All species	15,518,270	4,418,110	6,035,670	1,546,440	2,190,270	1,327,780

1/ International 1/4-inch rule.

Table 27.--Volume of sawtimber on commercial forest land, by species and log grades, Minnesota, 1962

(In thousand board feet)[1/]

Species	Log grades				
	All grades	Grade 1	Grade 2	Grade 3	Tie and timber
Softwoods:					
White and red pine	2,581,940	18,330	534,490	2,029,120	-
Spruce and balsam fir	1,727,370	-	10,270	1,717,100	-
Other softwoods	2,250,220	3,080	43,930	2,203,210	-
Total softwoods	6,559,530	21,410	588,690	5,949,430	-
Hardwoods:					
Select white and red oaks	1,486,110	26,160	120,480	727,450	612,020
Other white and red oaks	-	-	-	-	-
Yellow birch	79,620	16,860	28,600	32,810	1,350
Hard maple	465,630	14,070	33,340	73,700	344,520
Ash, walnut and black cherry	756,830	48,480	104,600	349,900	253,850
Other hardwoods	6,170,550	466,500	1,080,940	2,791,910	1,831,200
Total hardwoods	8,958,740	572,070	1,367,960	3,975,770	3,042,940
All species	15,518,270	593,480	1,956,650	9,925,200	3,042,940

1/ International 1/4-inch rule.

Table 28.--Volume of salvable dead sawtimber-size trees on commercial forest land, by species, Minnesota, 1953 and 1962

(In thousand board feet)[1/]

Species group	Volume
Softwoods	9,786
Hardwoods	1,800
All species	11,586

1/ International 1/4-inch log rule.
NOTE: Refinements in computing and additional data have made some of these statistics different from those reported in "Timber Trends in the U.S.", Forest Resource Report No. 17, published by the Forest Service, U.S. Dept. Agr., in 1965.

Table 29.--Volume of growing stock on commercial forest land, by species, Minnesota, 1953 and 1962

(In thousand cubic feet)

Species	1953	1962
Softwoods:		
White pine	220,000	203,875
Red pine	235,000	345,483
Jack pine	771,000	815,564
Balsam fir	441,000	715,772
White spruce	152,000	181,178
Black spruce	579,000	763,709
Tamarack	218,000	318,631
Cedar	213,000	263,054
Total softwoods	2,829,000	3,607,266
Hardwoods:		
Hard maple	124,000	137,855
Yellow birch	15,000	17,341
Basswood	297,000	347,197
Balsam poplar	154,000	371,924
Elm	353,000	384,114
Red oak	484,000	373,583
White oak	286,000	204,871
Aspen	1,812,000	3,018,171
Cottonwood	50,000	6,834
Paper birch	416,000	768,488
Soft maple	45,000	96,522
Ash	306,000	418,131
Other hardwoods	64,000	49,509
Total hardwoods	4,406,000	6,194,540
All species	7,235,000	9,801,806

Table 30.--Volume of sawtimber on commercial forest land, by species, Minnesota, 1953 and 1962

(In thousand board feet)[1/]

Species	1953	1962
Softwoods:		
White pine	868,000	956,750
Red pine	850,000	1,625,190
Jack pine	1,420,000	1,560,200
Balsam fir	504,000	740,260
White spruce	473,000	651,730
Black spruce	363,000	335,380
Tamarack	166,000	296,450
Cedar	395,000	393,570
Total softwoods	5,039,000	6,559,530
Hardwoods:		
Hard maple	261,000	465,630
Yellow birch	53,000	79,620
Basswood	833,000	1,040,140
Balsam poplar	225,000	530,860
Elm	1,167,000	1,413,890
Red oak	1,218,000	885,400
White oak	714,000	600,710
Aspen	1,716,000	2,387,860
Cottonwood	211,000	39,110
Paper birch	405,000	448,280
Soft maple	104,000	238,050
Ash	462,000	743,830
Other hardwoods	130,000	85,360
Total hardwoods	7,499,000	8,958,740
All species	12,538,000	15,518,270

1/ International 1/4-inch rule.

Table 31.--Volume of growing stock and sawtimber on commercial forest land, by counties and species classes, Minnesota, 1962

LAKE SUPERIOR UNIT

County	Growing stock			Sawtimber		
	All growing stock	Softwoods	Hardwoods	All sawtimber	Softwoods	Hardwoods
	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand bd. ft.	Thousand bd. ft.	Thousand bd. ft.
Carlton	112,204	28,764	83,440	118,770	40,110	78,660
Cook	563,452	305,359	258,093	839,720	511,060	328,660
Lake	758,139	380,243	377,896	899,480	476,280	423,200
Pine	117,015	11,447	105,568	174,510	25,470	149,040
St. Louis	1,987,932	918,430	1,069,502	2,385,630	1,534,540	851,090
Total	3,538,742	1,644,243	1,894,499	4,418,110	2,587,460	1,830,650
CENTRAL PINE UNIT						
Aitkin	437,802	94,974	342,828	827,980	176,230	651,750
Becker	247,807	49,928	197,879	395,890	155,200	240,690
Beltrami	479,245	165,039	314,206	685,140	254,920	430,220
Cass	588,131	192,491	395,640	772,250	466,190	306,060
Clearwater	218,080	33,038	185,042	332,370	106,300	226,070
Crow Wing	323,979	73,193	250,786	438,390	187,250	251,140
Hubbard	240,192	82,713	157,479	275,100	182,090	93,010
Itasca	1,086,416	396,477	689,939	2,252,740	1,313,820	938,920
Wadena	40,464	24,972	15,492	55,810	36,440	19,370
Total	3,662,116	1,112,825	2,549,291	6,035,670	2,878,440	3,157,230
RAINY RIVER UNIT						
Koochiching	1,127,409	625,996	501,413	1,307,040	729,670	577,370
Lake of the Woods	219,083	134,656	84,427	239,400	151,130	88,270
Total	1,346,492	760,652	585,840	1,546,440	880,800	665,640
SOUTHEASTERN UNIT						
Anoka	22,854	3,934	18,920	48,140	3,450	44,690
Benton	10,041	205	9,836	30,350	40	30,310
Carver	10,910	87	10,823	45,110	-	45,110
Chisago	19,426	1,446	17,980	67,800	1,370	66,430
Dakota	11,929	166	11,763	44,670	-	44,670
Douglas	16,756	213	16,543	58,050	-	58,050
Fillmore	44,192	300	43,892	173,860	40	173,820
Goodhue	33,283	205	33,078	134,400	-	134,400
Hennepin	12,569	103	12,466	56,590	40	56,550
Houston	59,779	356	59,423	240,860	80	240,780
Isanti	18,170	1,288	16,882	54,130	1,100	53,030
Kanabec	48,901	916	47,985	37,960	1,680	36,280
Le Sueur	15,271	40	15,231	70,290	-	70,290
Mille Lacs	43,545	2,694	40,851	61,450	5,440	56,010
Morrison	58,950	7,181	51,769	102,030	27,450	74,580

(Continued)

Table 31 (Cont'd)

SOUTHEASTERN UNIT

County	Growing stock			Sawtimber		
	All growing stock	Softwoods	Hardwoods	All sawtimber	Softwoods	Hardwoods
	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand bd. ft.	Thousand bd. ft.	Thousand bd. ft.
Olmsted	25,059	103	24,956	96,600	-	96,600
Otter Tail	81,299	7,702	73,597	125,170	16,150	109,020
Ramsey	1,501	-	1,501	11,610	-	11,610
Rice	9,741	-	9,741	44,360	-	44,360
Scott	10,152	40	10,112	43,310	-	43,310
Sherburne	12,845	782	12,063	40,890	590	40,300
Stearns	30,288	395	29,893	105,010	270	104,740
Todd	47,913	4,306	43,607	81,730	15,950	65,780
Wabasha	24,506	213	24,293	95,270	-	95,270
Washington	12,048	142	11,906	47,600	40	47,560
Winona	47,463	616	46,847	181,590	-	181,590
Wright	20,382	118	20,264	91,440	-	91,440
Total	749,773	33,551	716,222	2,190,270	73,690	2,116,580

WESTERN UNIT

Big Stone	2,323	24	2,299	5,770	-	5,770
Blue Earth	19,315	150	19,165	99,540	-	99,540
Brown	9,085	118	8,967	39,280	-	39,280
Chippewa	2,433	32	2,401	10,980	-	10,980
Clay	4,740	-	4,740	14,320	-	14,320
Cottonwood	5,546	24	5,522	28,110	-	28,110
Dodge	6,257	39	6,218	24,120	-	24,120
Faribault	6,525	63	6,462	32,750	-	32,750
Freeborn	10,065	79	9,986	38,340	-	38,340
Grant	3,271	47	3,224	14,170	-	14,170
Jackson	4,432	32	4,400	23,380	-	23,380
Kandiyohi	11,818	95	11,723	46,370	-	46,370
Kittson	18,786	-	18,786	13,960	-	13,960
Lac qui Parle	3,294	32	3,262	16,180	-	16,180
Lincoln	1,762	24	1,738	7,500	-	7,500
Lyon	3,879	32	3,847	20,080	-	20,080
Mahnomen	93,560	7,078	86,482	106,910	26,710	80,200
Marshall	28,716	2,330	26,386	26,660	5,700	20,960
Martin	2,481	32	2,449	11,120	-	11,120
McLeod	7,655	47	7,608	38,760	-	38,760
Meeker	12,189	103	12,086	57,600	-	57,600
Mower	6,731	63	6,668	30,240	-	30,240
Murray	2,733	39	2,694	11,970	-	11,970
Nicollet	8,666	79	8,587	38,870	-	38,870
Nobles	1,153	24	1,129	5,260	-	5,260

(Continued)

Table 31 (cont'd)

WESTERN UNIT

County	Growing stock			Sawtimber		
	All growing stock	Softwoods	Hardwoods	All sawtimber	Softwoods	Hardwoods
	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand bd. ft.	Thousand bd. ft.	Thousand bd. ft.
Norman	8,414	-	8,414	23,670	-	23,670
Pennington	7,363	-	7,363	10,010	-	10,010
Pipestone	1,375	16	1,359	5,300	-	5,300
Polk	17,079	608	16,471	23,390	1,500	21,890
Pope	9,180	71	9,109	35,000	-	35,000
Red Lake	10,499	-	10,499	14,430	-	14,430
Redwood	5,791	47	5,744	23,260	-	23,260
Renville	10,033	79	9,954	43,670	-	43,670
Rock	1,035	24	1,011	4,170	-	4,170
Roseau	114,408	44,256	70,152	180,850	105,230	75,620
Sibley	16,108	111	15,997	78,480	-	78,480
Steele	5,222	47	5,175	24,020	-	24,020
Stevens	1,738	-	1,738	10,840	-	10,840
Swift	4,614	39	4,575	22,480	-	22,480
Traverse	308	8	300	1,690	-	1,690
Waseca	5,728	32	5,696	22,570	-	22,570
Watonwan	2,030	24	2,006	9,220	-	9,220
Wilkin	1,706	-	1,706	9,940	-	9,940
Yellow Medicine	4,637	47	4,590	22,550	-	22,550
Total	504,683	55,995	448,688	1,327,780	139,140	1,188,640

ALL UNITS

All counties	9,801,806	3,607,266	6,194,540	15,518,270	6,559,530	8,958,740

Table 32.--Net annual growth of growing stock on commercial forest land, by species and Forest Survey Units, Minnesota, 1962

(In thousand cubic feet)

Species	All units	Lake Superior	Central Pine	Rainy River	South-eastern	Western
Softwoods:						
White pine	2,986	1,566	893	388	133	6
Red pine	17,684	5,370	11,040	743	140	391
Jack pine	28,453	10,136	14,829	1,966	353	1,169
Balsam fir	13,108	10,168	192	2,750	-	-2
White spruce	7,932	4,115	1,967	1,736	30	84
Black spruce	16,747	6,383	288	9,891	6	179
Tamarack	6,341	752	2,353	2,236	829	171
Cedar	7,342	1,522	3,480	2,229	-	111
Total softwoods	100,593	40,012	35,042	21,939	1,491	2,109
Hardwoods:						
Hard maple	2,985	680	1,094	17	990	204
Yellow birch	-20	24	-52	-	8	-
Basswood	14,703	339	7,285	287	4,952	1,840
Balsam poplar	14,481	4,019	2,780	2,872	2,570	2,240
Elm	7,245	-175	759	453	3,492	2,716
Red oak	13,763	554	8,738	11	4,078	382
White oak	7,296	207	2,050	43	3,511	1,485
Aspen	173,241	68,507	60,144	19,308	11,570	13,712
Cottonwood	66	-	-	-	28	38
Paper birch	27,981	11,442	13,127	1,085	2,038	289
Soft maple	3,248	1,237	727	32	822	430
Ash	10,783	1,311	1,690	916	4,824	2,042
Other hardwoods	3,844	75	435	8	3,121	205
Total hardwoods	279,616	88,220	98,777	25,032	42,004	25,583
All species	380,209	128,232	133,819	46,971	43,495	27,692

NOTE: Refinements in computing and additional data have made some of these statistics different from those reported in "Timber Trends in the U.S.", Forest Resource Report No. 17, published by the Forest Service, U.S. Dept. Agr., in 1965.

Table 33.--Net annual growth of sawtimber on commercial forest land, by species and Forest Survey Units, Minnesota, 1962

(In thousand board feet)[1/]

Species	All units	Lake Superior	Central Pine	Rainy River	South-eastern	Western
Softwoods:						
White pine	13,860	6,330	5,630	1,500	390	10
Red pine	102,460	23,000	73,810	3,120	-	2,530
Jack pine	79,840	25,660	40,520	4,480	4,200	4,980
Balsam fir	21,470	9,240	10,950	1,430	-	-150
White spruce	36,270	19,800	13,150	2,960	240	120
Black spruce	20,820	6,870	3,590	10,290	-	70
Tamarack	15,680	830	8,470	4,540	1,020	820
Cedar	18,170	3,330	12,700	1,840	-	300
Total softwoods	308,570	95,060	168,820	30,160	5,850	8,680
Hardwoods:						
Hard maple	11,140	1,890	6,940	100	1,660	550
Yellow birch	250	400	-160	-	10	-
Basswood	40,600	190	27,220	220	8,110	4,860
Balsam poplar	33,190	11,050	11,330	4,510	530	5,770
Elm	31,550	-1,970	10,230	330	12,940	10,020
Red oak	57,530	2,660	35,260	-	16,930	2,680
White oak	15,160	170	5,100	-	4,750	5,140
Aspen	273,210	99,670	136,770	9,460	17,280	10,030
Cottonwood	670	-	-	-	110	560
Paper birch	26,370	10,240	13,490	520	1,960	160
Soft maple	4,170	10	370	100	1,540	2,150
Ash	25,680	3,050	9,300	1,390	4,440	7,500
Other hardwoods	1,420	-	-	-	1,160	260
Total hardwoods	520,940	127,360	255,850	16,630	71,420	49,680
All species	829,510	222,420	424,670	46,790	77,270	58,360

1/ International 1/4-inch rule.

NOTE: Refinements in computing and additional data have made some of these statistics different from those reported in "Timber Trends in the U.S.", Forest Resource Report No. 17, published by the Forest Service, U.S. Dept. Agr., in 1965.

Table 34.--Annual mortality of growing stock and sawtimber on commercial forest land, by species, Minnesota, 1962

Species	Growing stock	Sawtimber
	Thousand cu. ft.	Thousand bd. ft. 1/
Softwoods:		
White pine	1,509	5,165
Red pine	3,267	13,396
Jack pine	11,297	19,421
Balsam fir	20,402	31,716
White spruce	2,168	6,035
Black spruce	11,112	5,655
Tamarack	4,351	2,069
Cedar	2,296	3,100
Total softwoods	56,402	86,557
Hardwoods:		
Hard maple	233	678
Yellow birch	324	1,639
Basswood	312	1,043
Balsam poplar	1,226	1,375
Elm	2,857	7,830
Red oak	623	1,494
White oak	780	2,055
Aspen	40,335	29,717
Cottonwood	25	96
Paper birch	4,024	1,870
Soft maple	277	871
Ash	4,218	3,505
Other hardwoods	322	287
Total hardwoods	55,556	52,460
All species	111,958	139,017

1/ International 1/4-inch rule.

NOTE: Refinements in computing and additional data have made some of these statistics different from those reported in "Timber Trends in the U.S.", Forest Resource Report No. 17, published by the Forest Service, U.S. Dept. Agr., in 1965.

Table 35.--Annual mortality of growing stock and sawtimber on commercial forest land, by ownership and species classes, Minnesota, 1962

GROWING STOCK

(In thousand cubic feet)

Ownership class	All species	Softwoods	Hardwoods
National Forest	21,403	14,156	7,247
Other public	48,323	26,952	21,371
Forest industry	7,081	4,437	2,644
Farmer and misc. private	35,151	10,857	24,294
All ownerships	111,958	56,402	55,556

SAWTIMBER

(In thousand board feet) 1/

National Forest	19,832	16,274	3,558
Other public	59,691	43,100	16,591
Forest industry	9,273	7,011	2,262
Farmer and misc. private	50,221	20,172	30,049
All ownerships	139,017	86,557	52,460

1/ International 1/4-inch rule.

NOTE: Refinements in computing and additional data have made some of these statistics different from those reported in "Timber Trends in the U.S.", Forest Resource Report No. 17, published by the Forest Service, U.S. Dept. Agr., in 1965.

Table 36.--Annual mortality of growing stock and sawtimber on commercial forest land, by causes and species classes, Minnesota, 1962

GROWING STOCK

(In thousand cubic feet)

Cause of death	All species	Softwoods	Hardwoods
Fire	11,912	10,827	1,085
Insects	6,193	6,061	132
Disease	40,557	10,244	30,313
Other	49,505	28,749	20,756
Unknown	3,791	521	3,270
All causes	111,958	56,402	55,556

SAWTIMBER

(Thousand board feet)1/

Fire	144	-	144
Insects	13,382	12,951	431
Disease	50,012	17,335	32,677
Other	68,570	51,804	16,766
Unknown	6,909	4,467	2,442
All causes	139,017	86,557	52,460

1/ International 1/4-inch rule.

NOTE: Refinements in computing and additional data have made some of these statistics different from those reported in "Timber Trends in the U.S.", Forest Resource Report No. 17, published by the Forest Service, U.S. Dept. Agr., in 1965.

Table 37.--Annual timber cut from growing stock on commercial forest land, by species and Forest Survey Units, Minnesota, 1960

(In thousand cubic feet)

Species	All units	Lake Superior	Central Pine	Rainy River	South-eastern	Western
Softwoods:						
White pine	3,274	1,380	1,166	545	173	10
Red pine	2,851	787	1,850	120	90	4
Jack pine	21,848	11,493	8,009	1,185	248	913
Balsam fir	10,663	4,539	3,653	2,315	25	131
Spruce	19,332	10,871	3,177	5,075	55	154
Tamarack	2,637	589	1,270	315	413	50
Cedar	1,913	541	491	810	*	71
Total softwoods	62,518	30,200	19,616	10,365	1,004	1,333
Hardwoods:						
Hard maple	672	87	147	-	389	49
Yellow birch	444	345	83	10	4	2
Basswood	2,057	44	371	15	1,433	194
Balsam poplar	865	79	126	660	-	-
Elm	2,514	49	256	10	1,796	403
Red oak	5,166	156	910	-	3,750	350
White oak	3,607	9	432	10	2,627	529
Aspen	41,620	14,613	17,426	6,435	1,175	1,971
Cottonwood	1,155	-	-	-	397	758
Paper birch	2,460	851	1,337	100	132	40
Soft maple	452	5	53	-	344	50
Ash	1,513	141	534	85	571	182
Walnut	66	-	-	-	30	36
Other	536	*	*	*	229	307
Total hardwoods	63,127	16,379	21,675	7,325	12,877	4,871
All species	125,645	46,579	41,291	17,690	13,881	6,204

* Less than 500 cubic feet.

NOTE: Refinements in computing and additional data have made some of these statistics different from those reported in "Timber Trends in the U.S.", Forest Resource Report No. 17, published by the Forest Service, U.S. Dept. Agr., in 1965.

Table 38.--Annual timber cut from live sawtimber on commercial forest land, by species and Forest Survey Units, Minnesota, 1960

(In thousand board feet)[1/]

Species	All units	Lake Superior	Central Pine	Rainy River	South-eastern	Western
Softwoods:						
White pine	19,880	8,350	7,120	3,290	1,050	70
Red pine	14,600	4,150	9,300	640	490	20
Jack pine	53,100	23,660	23,050	2,760	740	2,890
Balsam fir	18,720	7,940	6,720	3,780	70	210
Spruce	44,450	24,650	7,310	11,770	230	490
Tamarack	5,570	1,280	2,740	760	600	190
Cedar	3,830	1,950	640	1,140	*	100
Total softwoods	160,150	71,980	56,880	24,140	3,180	3,970
Hardwoods:						
Hard maple	1,860	210	260	*	1,240	150
Yellow birch	1,900	1,390	400	70	20	20
Basswood	11,020	270	2,230	110	7,550	860
Balsam poplar	1,510	100	580	830	-	-
Elm	10,570	310	1,060	80	7,450	1,670
Red oak	18,260	430	2,190	*	14,500	1,140
White oak	10,710	20	1,000	40	7,680	1,970
Aspen	82,120	28,180	36,700	10,560	3,050	3,630
Cottonwood	5,930	-	-	-	2,340	3,590
Paper birch	7,810	3,650	3,430	410	210	110
Soft maple	2,160	30	160	*	1,800	170
Ash	5,140	510	1,980	360	1,810	480
Walnut	260	-	-	-	180	80
Other	980	*	*	*	530	450
Total hardwoods	160,230	35,100	49,990	12,460	48,360	14,320
All species	320,380	107,080	106,870	36,600	51,540	18,290

1/ International 1/4-inch rule.

* Less than 5,000 board feet.

NOTE: Refinements in computing and additional data have made some of these statistics different from those reported in "Timber Trends in the U.S.", Forest Resource Report No. 17, published by the Forest Service, U.S. Dept. Agr., in 1965.

Table 39.--Total output of timber products, by type of material used and species classes, Minnesota, 1960

Product and species class	Total output in standard units		Output from roundwood				Output from plant by-products (std.units)
			From growing stock		From nongrowing stock		
	Unit	Number	Std.units	M cu.ft.	Std.units	M cu.ft.	
Saw logs and bolts:							
Softwood	M bd. ft.[1]	76,130	69,430	11,253	6,700	1,082	-
Hardwood	M bd. ft.[1]	91,980	77,780	12,681	14,200	2,315	-
Total	M bd. ft.[1]	168,110	147,210	23,934	20,900	3,397	-
Veneer logs and bolts:							
Softwood	M bd. ft.[1]	-	-	-	-	-	-
Hardwood	M bd. ft.[1]	9,940	9,930	1,407	10	2	-
Total	M bd. ft.[1]	9,940	9,930	1,407	10	2	-
Cooperage logs and bolts:							
Softwood	M bd. ft.[1]	-	-	-	-	-	-
Hardwood	M bd. ft.[1]	3,060	2,620	366	440	61	-
Total	M bd. ft.[1]	3,060	2,620	366	440	61	-
Pulpwood:							
Softwood	M cords[2]	645	575	45,917	70	5,540	-
Hardwood	M cords[2]	403	360	28,360	43	3,369	-
Total	M cords[2]	1,048	935	74,277	113	8,909	-
Piling:							
Softwood	M linear ft.	159	159	105	-	-	-
Hardwood	M linear ft.	-	-	-	-	-	-
Total	M linear ft.	159	159	105	-	-	-
Poles:							
Softwood	M pieces	231	218	1,254	13	75	-
Hardwood	M pieces	-	-	-	-	-	-
Total	M pieces	231	218	1,254	13	75	-
Mine timbers (round):							
Softwood	M cu. ft.	469	388	388	81	81	-
Hardwood	M cu. ft.	112	93	93	19	19	-
Total	M cu. ft.	581	481	481	100	100	-
Miscellaneous industrial wood:[3]							
Softwood	M cu. ft.	145	145	145	-	-	-
Hardwood	M cu. ft.	2,115	1,815	1,815	173	173	127
Total	M cu. ft.	2,260	1,960	1,960	173	173	127
Posts (round and split):							
Softwood	M pieces	2,000	1,600	1,289	400	295	-
Hardwood	M pieces	2,500	1,500	1,522	1,000	927	-
Total	M pieces	4,500	3,100	2,811	1,400	1,222	-
Fuelwood:							
Softwood	M cords	68	20	1,360	26	1,796	22
Hardwood	M cords	539	212	14,503	279	19,093	48
Total	M cords	607	232	15,863	305	20,889	70
All products:							
Softwood	M cu. ft.	72,145	X	61,711	X	8,869	1,565
Hardwood	M cu. ft.	90,167	X	60,747	X	25,959	3,461
Total	M cu. ft.	162,312	X	122,458	X	34,828	5,026

1/ International 1/4-inch rule.
2/ Rough wood basis.
3/ Includes hewn ties, cabin logs, match bolts, charcoal wood, lath, shingle bolts, etc.
NOTE: Refinements in computing and additional data have made some of these statistics different from those reported in "Timber Trends in the U.S.", Forest Resource Report No. 17, published by the Forest Service, U.S. Dept. Agr., in 1965.

Table 40.--Total output of roundwood products by source and species classes, Minnesota, 1960

(In thousand cubic feet)

Source	All species	Softwoods	Hardwoods
Growing-stock trees[1]			
Sawtimber trees	68,664	39,338	29,326
Poletimber trees	53,794	22,373	31,421
Total	122,458	61,711	60,747
Cull trees[1]	11,273	6,065	5,208
Salvable dead trees[1]	3,798	1,574	2,224
Other sources[2]	19,757	1,230	18,527
All sources	157,286	70,580	86,706

1/ On commercial forest land.
2/ Includes noncommercial forest land, nonforest land (such as fence rows), trees less than 5.0 inches in diameter, and limbwood.
NOTE: Refinements in computing and additional data have made some of these statistics different from those reported in "Timber Trends in the U.S.", Forest Resource Report No. 17, published by the Forest Service, U.S. Dept. Agr., in 1965.

Table 41.--Number of operating primary wood-using plants, by Forest Survey Units, Minnesota, 1960

Kind of plant	All units	Lake Superior	Central Pine	Rainy River	South-eastern	Western
Sawmills:						
Large[1]	1	1	-	-	-	-
Medium[2]	26	8	10	1	7	-
Small[3]	1,255	283	359	47	348	218
Pulpmills	9	3	2	1	3	-
Veneer mills:						
Standard grade	1	-	1	-	-	-
Container	6	-	-	-	6	-
Excelsior plants	-	-	-	-	-	-
Charcoal plants	6	-	4	-	2	-
Cooperage plants	3	-	1	-	2	-
Miscellaneous plants[4]	38	9	17	4	6	2
All plants	1,345	304	394	53	374	220

1/ Annual lumber production, 5 million board feet or more.
2/ Annual lumber production, 1 to 5 million board feet.
3/ Annual lumber production, less than 1 million board feet.
4/ Includes match, rustic fence, woodenware, novelty, lath, and shingle plants.

Table 42.--Annual timber cut from growing stock on commercial forest land, by species, Minnesota, in 1936, 1953, and 1960

(In thousand cubic feet)

Species	Annual timber cut		
	1936	1953	1960
Softwoods:			
White pine	8,210	4,363	3,274
Red pine	3,660	5,475	2,851
Jack pine	12,040	25,326	21,848
Spruce	20,470	23,617	19,332
Balsam fir	8,510	13,375	10,663
Tamarack	3,380	3,074	2,637
Cedar	4,030	2,736	1,913
Total	60,300	77,966	62,518
Hardwoods:			
Hard maple	500	1,169	672
Yellow birch	910	544	444
Basswood	4,200	3,058	2,057
Balsam poplar	(1/)	400	865
Elm	4,610	3,955	2,514
Red oak	8,000	10,453	5,166
White oak	2,670	3,484	3,607
Aspen	22,100	43,949	41,620
Cottonwood	(1/)	1,686	1,155
Paper birch	4,670	3,517	2,460
Soft maple	160	537	452
Ash	(1/)	2,020	1,513
Walnut	(1/)	180	66
Other hardwoods	2,180	1,234	536
Total	50,000	76,186	63,127
All species	110,300	154,152	125,645

1/ Species data not available, included with other hardwoods.

NOTE: Refinements in computing and additional data have made some of these statistics different from those reported in "Timber Trends in the U.S.", Forest Resource Report No. 17, published by the Forest Service, U.S. Dept. Agr., in 1965.

Table 43.--Annual timber cut from growing stock on commercial forest land, by products and logging residues and species classes, Minnesota, 1960

(In thousand cubic feet)

Products and residues	All species	Softwoods	Hardwoods
Roundwood products:			
Saw logs and bolts	23,934	11,253	12,681
Veneer logs and bolts	1,407	-	1,407
Cooperage logs and bolts	366	-	366
Pulpwood	74,277	45,917	28,360
Piling	105	105	-
Poles	1,254	1,254	-
Mine timbers	481	388	93
Misc. industrial wood	1,960	145	1,815
Posts	2,811	1,289	1,522
Fuelwood	15,863	1,360	14,503
All products	122,458	61,711	60,747
Logging residues	3,187	807	2,380
Timber cut	125,645	62,518	63,127

NOTE: Refinements in computing and additional data have made some of these statistics different from those reported in "Timber Trends in the U.S.", Forest Resource Report No. 17, published by the Forest Service, U.S. Dept. Agr., in 1965.

Table 44.--Annual timber cut from live sawtimber on commercial forest land, by products and logging residues and species classes, Minnesota, 1960

(In thousand board feet) 1/

Products and residues	All species	Softwoods	Hardwoods
Roundwood products:			
Saw logs and bolts	134,880	63,410	71,470
Veneer logs and bolts	9,810	-	9,810
Cooperage logs and bolts	2,750	-	2,750
Pulpwood	124,000	88,190	35,810
Piling	480	480	-
Poles	2,570	2,570	-
Mine timbers	1,390	1,120	270
Misc. industrial wood	10,560	800	9,760
Posts	3,830	550	3,280
Fuelwood	22,050	1,890	20,160
All products	312,320	159,010	153,310
Logging residues	8,060	1,140	6,920
Timber cut	320,380	160,150	160,230

1/ International 1/4-inch rule.

NOTE: Refinements in computing and additional data have made some of these statistics different from those reported in "Timber Trends in the U.S.", Forest Resource Report No. 17, published by the Forest Service, U.S. Dept. Agr., in 1965.

Table 45.--Volume of unused plant residues, by industrial sources and type of residue and by species class, Minnesota, 1960

(In thousand cubic feet)

Industrial source	Species class and character of residues								
	All species			Softwoods			Hardwoods		
	Total	Coarse 1/	Fine 2/	Total	Coarse	Fine	Total	Coarse	Fine
Lumber industry	5,720	2,411	3,309	2,974	1,290	1,684	2,746	1,121	1,625
Veneer industry	23	6	17	-	-	-	23	6	17
Other primary industries	187	55	132	20	20	-	167	35	132
Total	5,930	2,472	3,458	2,994	1,310	1,684	2,936	1,162	1,774

1/ Unused material suitable for chipping, such as slabs, edgings, and veneer cores.
2/ Unused material not suitable for chipping, such as sawdust and shavings.

NOTE: Refinements in computing and additional data have made some of these statistics different from those reported in "Timber Trends in the U.S.", Forest Resource Report No. 17, published by the Forest Service, U.S. Dept. Agr., in 1965.

Table 46.--Annual desirable cut of growing stock on commercial forest land, by species and Forest Survey Units, Minnesota, 1962

(In thousand cubic feet)

Species	All units	Lake Superior	Central Pine	Rainy River	South-eastern	Western
Softwoods:						
White pine	5,388	2,939	1,240	1,162	47	-
Red pine	3,389	1,477	1,730	182	-	-
Jack pine	31,995	21,298	7,971	1,382	285	1,059
Balsam fir	30,802	15,547	8,461	6,747	-	47
White spruce	6,438	4,693	616	1,058	55	16
Black spruce	22,452	10,049	2,576	9,693	-	134
Tamarack	4,969	111	1,935	2,006	672	245
Cedar	10,515	3,468	2,868	3,942	-	237
Total softwoods	115,948	59,582	27,397	26,172	1,059	1,738
Hardwoods:						
Hard maple	2,386	514	901	8	758	205
Yellow birch	340	245	95	-	-	-
Basswood	4,685	71	1,335	387	1,865	1,027
Balsam poplar	17,562	4,938	5,435	4,629	237	2,323
Elm	8,856	450	2,307	1,114	3,421	1,564
Red oak	5,230	134	1,067	71	3,808	150
White oak	4,029	63	585	40	2,441	900
Aspen	128,904	57,030	52,289	12,680	3,318	3,587
Cottonwood	126	-	-	-	110	16
Paper birch	19,663	10,120	6,952	1,904	600	87
Soft maple	1,943	419	466	63	877	118
Ash	7,426	1,943	1,675	1,564	1,738	506
Other hardwoods	1,430	-	-	-	1,177	253
Total hardwoods	202,580	75,927	73,107	22,460	20,350	10,736
All species	318,528	135,509	100,504	48,632	21,409	12,474

Table 47.--Annual desirable cut of live sawtimber on commercial forest land, by species and Forest Survey Units, Minnesota, 1962

(In thousand board feet)[1/]

Species	All units	Lake Superior	Central Pine	Rainy River	South-eastern	Western
Softwoods:						
White pine	24,296	12,100	5,800	6,000	296	100
Red pine	15,900	7,000	7,900	900	-	100
Jack pine	69,091	36,800	24,700	2,400	1,291	3,900
Balsam fir	36,100	14,900	14,600	6,600	-	-
White spruce	20,819	13,600	2,600	4,200	319	100
Black spruce	12,200	7,500	1,300	3,400	-	-
Tamarack	6,487	-	2,200	3,200	586	501
Cedar	20,500	8,100	5,800	6,600	-	-
Total softwoods	205,393	100,000	64,900	33,300	2,492	4,701
Hardwoods:						
Hard maple	12,824	1,600	5,300	-	4,282	1,642
Yellow birch	1,600	1,100	500	-	-	-
Basswood	20,965	400	6,100	1,200	8,852	4,413
Balsam poplar	30,922	8,600	12,500	6,900	871	2,051
Elm	44,020	2,700	11,500	4,100	16,459	9,261
Red oak	22,265	200	4,800	300	16,393	572
White oak	15,254	-	2,900	200	9,315	2,839
Aspen	169,386	74,500	67,000	17,500	6,153	4,233
Cottonwood	1,264	-	-	-	1,082	182
Paper birch	22,248	10,600	8,300	2,900	348	100
Soft maple	6,504	100	1,500	200	4,398	306
Ash	21,046	5,400	6,300	3,500	3,890	1,956
Other hardwoods	2,848	-	-	-	2,248	600
Total hardwoods	371,146	105,200	126,700	36,800	74,291	28,155
All species	576,539	205,200	191,600	70,100	76,783	32,856

1/ International 1/4-inch rule.

Table 48.--Net annual growth, annual cut, and desirable cut of growing stock on commercial forest land, by species classes and by ownership classes, Minnesota, 1962

(In thousand cubic feet)

NET ANNUAL GROWTH

Species class	All owners	National Forest	Other public	Forest industry	Farmer and misc. private
Softwoods	100,593	18,578	49,443	9,409	23,163
Hardwoods	279,616	32,680	104,274	13,740	128,922
All species	380,209	51,258	153,717	23,149	152,085

ANNUAL TIMBER CUT[1/]

Softwoods	62,518	16,968	23,814	6,610	15,126
Hardwoods	63,127	3,690	14,669	3,953	40,815
All species	125,645	20,658	38,483	10,563	55,941

DESIRABLE CUT

Softwoods	115,948	34,823	52,954	10,025	18,146
Hardwoods	202,580	33,978	81,299	9,907	77,396
All species	318,528	68,801	134,253	19,932	95,542

1/ Annual timber cut figures are for 1960.

NOTE: Refinements in computing and additional data have made some of these statistics different from those reported in "Timber Trends in the U.S.", Forest Resource Report No. 17, published by the Forest Service, U.S. Dept. Agr., in 1965.

Table 49.--Net annual growth, annual cut, and desirable cut of sawtimber on commercial forest land, by species classes and ownership classes, Minnesota, 1962

(In thousand board feet)[1/]

NET ANNUAL GROWTH

Species class	All owners	National Forest	Other public	Forest industry	Farmer and misc. private
Softwoods	308,570	59,020	151,320	20,570	77,660
Hardwoods	520,940	59,840	184,290	19,060	257,750
All species	829,510	118,860	335,610	39,630	335,410

ANNUAL TIMBER CUT[2/]

Softwoods	160,150	41,650	57,050	18,700	42,750
Hardwoods	160,230	11,150	33,600	9,700	105,780
All species	320,380	52,800	90,650	28,400	148,530

DESIRABLE CUT

Softwoods	205,393	48,700	92,396	23,700	40,597
Hardwoods	371,146	32,000	138,329	21,400	179,417
All species	576,539	80,700	230,725	45,100	220,014

1/ International 1/4-inch rule

2/ Annual timber cut figures are for 1960

NOTE: Refinement in computing and additional data have made some of these statistics different from those reported in "Timber Trends in the U.S.", Forest Resource Report No. 17, published by the Forest Service, U.S. Dept. Agr., in 1965.

Table 50.--Timber growth and cut projections, Minnesota, 1962 to 1992 [1/]

GROWING STOCK
(In thousand cubic feet)

Year	Assumed cut			Projected growth		
	All species	Softwoods	Hardwoods	All species	Softwoods	Hardwoods
1962	125,645	62,518	63,127	380,209	100,593	279,616
1972	141,700	71,600	70,100	386,600	95,300	291,300
1982	166,000	85,900	80,100	407,100	95,300	311,800
1992	199,600	107,800	91,800	432,600	95,600	337,300

SAWTIMBER
(In thousand board feet) [2/]

1962	320,380	160,150	160,230	829,510	308,570	520,940
1972	552,000	249,000	303,000	1,066,000	279,000	787,000
1982	639,000	282,000	357,000	1,495,000	295,000	1,200,000
1992	783,000	340,000	443,000	1,959,000	266,000	1,693,000

1/ Based on following assumptions as to forestry programs and other relevant factors:

(1) Annual planting rate of 50 million conifers.
(2) Regional increase in timber cut as indicated by Timber Trends in the United States.
(3) Elm mortality due to Dutch Elm Disease equal to 70 percent of present volume.
(4) Oak mortality after 1970 of twice the 1953-1962 rate.
(5) No withdrawal of commercial forest land from cutting other than the Boundary Waters Canoe Area expansion.

2/ International 1/4-inch rule.

RECENT REPORTS CONCERNING MINNESOTA'S TIMBER RESOURCES

The following Forest Survey Unit and County timber resource reports were published by the Office of Iron Range Resources and Rehabilitation in cooperation with the Lake States Forest Experiment Station and are available at Room 220, St. Louis County Court House, Hibbing, Minnesota, 55746.

Forest Survey Units:

Lake Superior	Central Pine

County Reports:

Aitkin	Itasca
Becker	Koochiching
Beltrami	Lake
Carlton	Lake of the Woods
Cass	Mahnomen
Clearwater	Pine
Cook	Roseau
Crow Wing	St. Louis
Hubbard	Wadena

The following Research Notes are available at the North Central Forest Experiment Station, Forest Service—U. S. Department of Agriculture, Folwell Avenue, St. Paul, Minnesota, 55101.

HORN, ARTHUR G.
1963. Changes in northern Minnesota timber harvest. U.S. Forest Serv. Res. Note LS-11, 4 pp., illus. Lake States Forest Exp. Sta., St. Paul, Minn.

STONE, ROBERT N., and VASILEVSKY, ALEX M.
1963. Forest area trends in Minnesota counties. U.S. Forest Serv. Res. Note LS-25, 4 pp., illus. Lake States Forest Exp. Sta., St. Paul, Minn.

DEBALD, PAUL S., and STONE, ROBERT N.
1964. Minnesota's timber volume. U.S. Forest Serv. Res. Note LS-43, 4 pp. Lake States Forest Exp. Sta., St. Paul, Minn.

VASILEVSKY, ALEX M., and STONE, ROBERT N.
1964. Ownership of commercial forest land in Minnesota, 1962. U.S. Forest Serv. Res. Note LS-44, 4 pp. Lake States Forest Exp. Sta., St. Paul, Minn.

CHASE, CLARENCE D.
1964. Forest type areas by counties, Minnesota, 1962. U.S. Forest Serv. Res. Note LS-55, 4 pp., illus. Lake States Forest Exp. Sta., St. Paul, Minn.

Stone, Robert N.

1966. A third look at Minnesota's timber. North Central Forest Exp. Sta., St. Paul, Minn. 64 pp., illus. (U.S. Forest Serv. Resource Bul. NC-1)

This report presents timber resource statistics for 1962 and compares them with those for 1953 and 1936. It contains 17 line illustrations and 50 tables that deal with forest area, number of trees, timber volume and growth, desirable cut, timber product output, and timber cut statistics. It also includes a 30-year projection of timber growth and cut. The comparisons show that timber volume has increased 37 percent since 1953, as Minnesota's second-growth forests approach maturity. Aspen dominates the resource in nearly all aspects. Though the acreage of commercial forest land is slightly less than before, a growing surplus of pulpwood-size timber suggests that the existing stands can support a larger cut than was advocated in 1953.

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1966. A third look at Minnesota's timber. North Central Forest Exp. Sta., St. Paul, Minn. 64 pp., illus. (U.S. Forest Serv. Resource Bul. NC-1)

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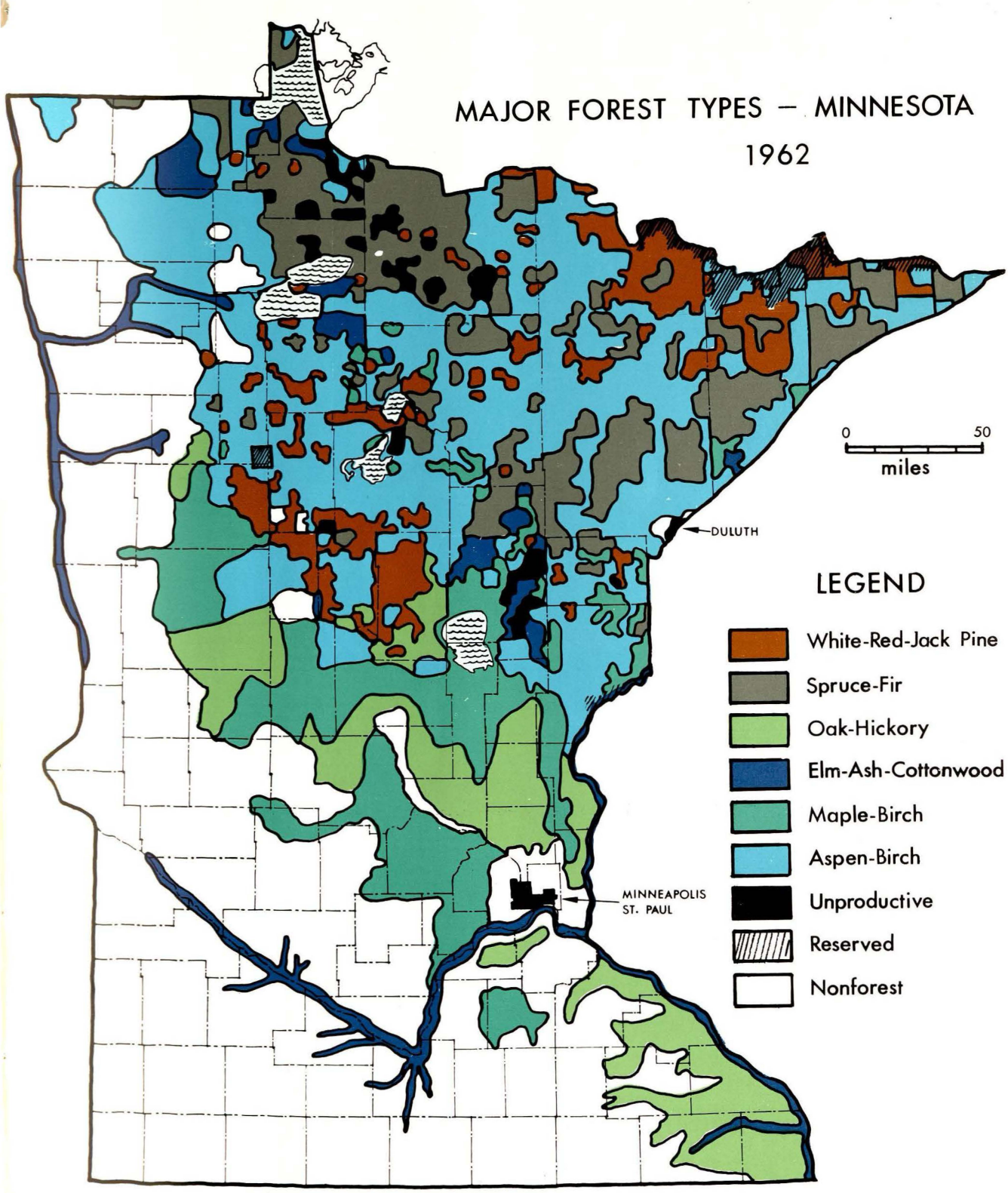
MAJOR FOREST TYPES — MINNESOTA
1962
0
50
miles
DULUTH
MINNEAPOLIS
ST. PAUL
LEGEND
White-Red-Jack Pine
Spruce-Fir
Oak-Hickory
Elm-Ash-Cottonwood
Maple-Birch
Aspen-Birch
Unproductive
Reserved
Nonforest

THE FOREST SERVICE CREED

The Forest Service of the U.S. Department of Agriculture is dedicated to the principle of multiple use management of the Nation's forest resources for sustained yields of wood, water, forage, wildlife, and recreation. Through forestry research, cooperation with the States and private forest owners, and management of the National Forests and National Grasslands, it strives — as directed by Congress — to provide increasingly greater service to a growing Nation.